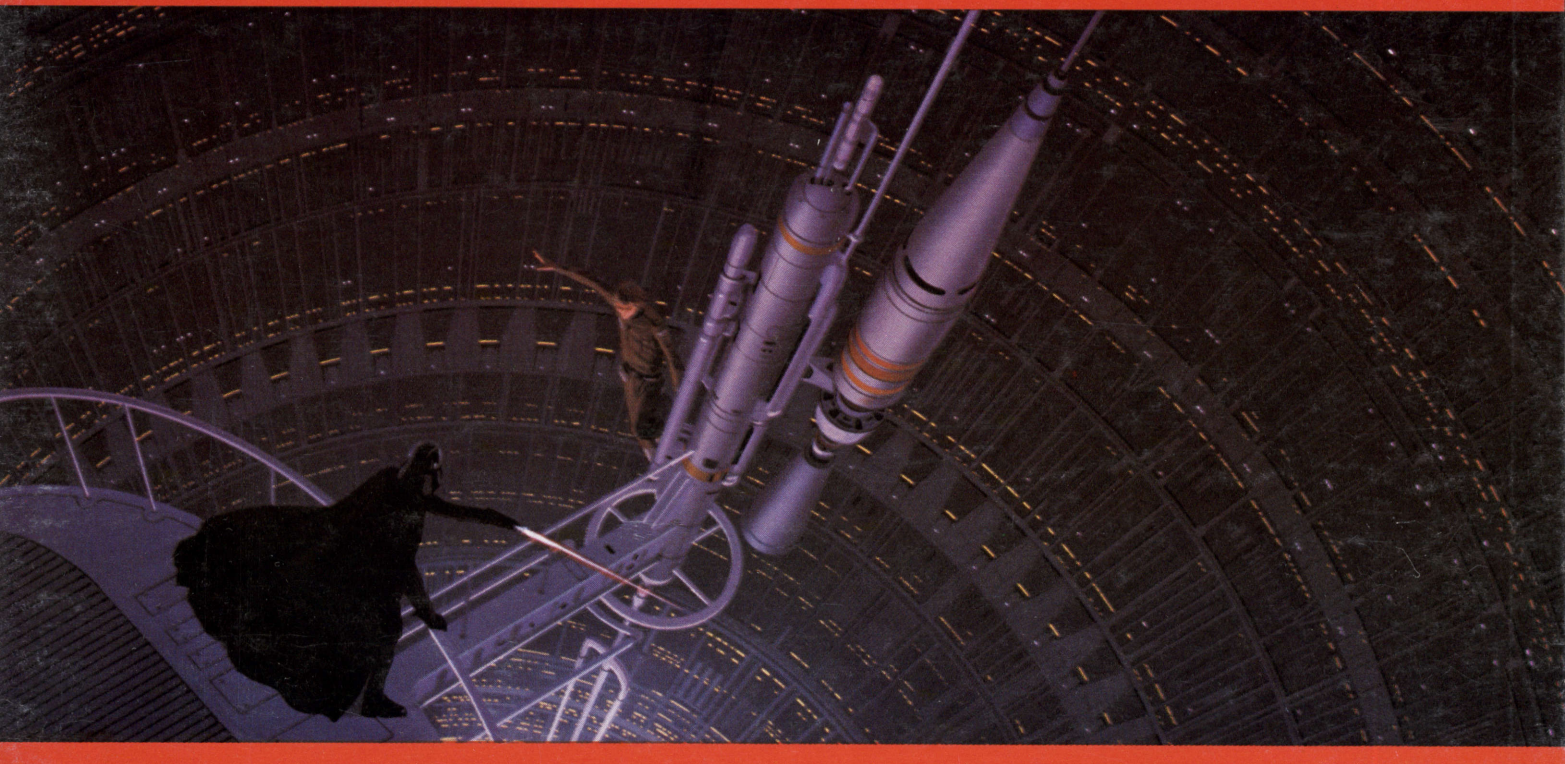
American Cinematographer

International Journal of Motion Picture Photography and Production Techniques

JUNE 1980/$2.00



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STAR WARS THE EMPIRE STRIKES BACK

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When it comes to creating delicate instrumentation, Swiss perfection is legend. No less so with the impeccably engineered BOLEX H-16 EBM. The product of 50 years of Bolex experience, it achieves a new standard of accuracy for 16mm cameras with a realistic price.

To fully appreciate this accomplishment, consider the imperatives of professional filmmaking. And how superbly the EBM serves them.

The First Imperative: Effortless Handling. The photo shows a fully equipped yet perfectly handheld camera—from its one-amp battery in the pistol grip to its unbelievable 16-100mm f/1.9 Vario Switar automatic power zoom lens with built-in light meter. Total weight of this rugged, ready-to-roam package? An incredible 12½ lbs.

The Second Imperative: Uncompromising Performance. All the essentials for professional results are gathered here: chronometer accurate electric film drive, suitable for synchronized sound with your choice of crystal or sync pulse generator. A diaphragm presetting device that lets you focus and frame with full light coming into the flickerless reflex viewfinder. And all the other niceties that help you refine your technique and your results, including: variable speeds from 10 to 50 fps, built-in filter slot, automatic threading and full rewind.

The Third Imperative: Adaptability. With its positive-locking large bayonet mount and optional C-mount adapter, you can attach virtually any lens to your Bolex EBM. And for stability under all shooting conditions, choose among our versatile tripod, precision-machined monopod, or shoulder brace.

There are two power supplies available for the Bolex EBM—as much power as you'll ever need for continuous studio or on-location shooting. And with the easy clip-on 400 ft. magazine, your film capacity is sure to measure up to all your shooting requirements.

The Final Imperative: Affordability. When we say that you can rig up a quite complete system for less than half the price of other high quality 16mm cameras, you may be astonished. So initially were the many pros who have since discovered that they needn't spend a fortune to own a system which can help them build one.

We urge you to inspect the Bolex EBM carefully before you purchase any other camera. And set the perfection of Swiss movement into motion for you. **Bolex...First in sixteen.**

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American Cinematographer

International Journal of Motion Picture Photography and Production Techniques

The American Society of Cinematographers is not a labor union or a guild, but is an educational, cultural and professional organization. Membership is by invitation to those who are actively engaged as Directors of Photography and have demonstrated outstanding ability. Not all cinematographers can place the initials A.S.C. after their names. A.S.C. membership has become one of the highest honors that can be bestowed upon a professional cinematographer, a mark of prestige and distinction.

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ON THE COVER: Production design renderings by Conceptual Artist Ralph McQuarrie for two sequences from THE EMPIRE STRIKES BACK, produced by Gary Kurtz, directed by Irvin Kershner, photographed by Peter Suschitzky, BSC, with George Lucas as Executive Producer. A Lucasfilm Ltd. Production. A Twentieth Century-Fox Release.

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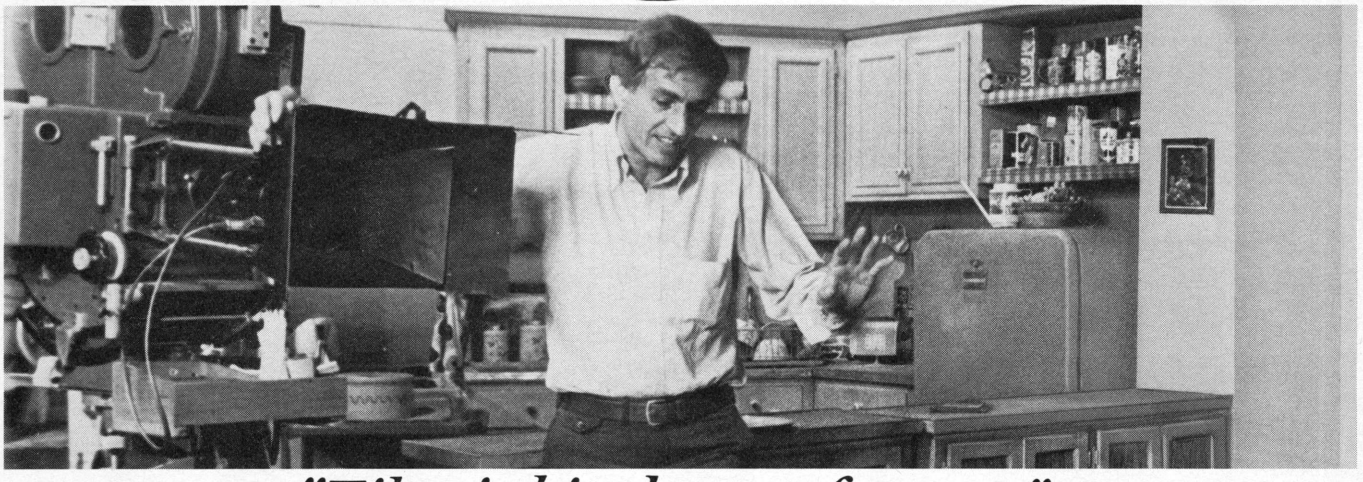

"Film is kind to performers."

"Few stars on television shine as brightly as those of Garry Marshall, producer of Mork and Mindy, Laverne and Shirley, Happy Days, and Angie. Garry credits the stars themselves, the stimulation of live audiences, and a technique of working with not one, but three cameras recording all the comedy subtleties on film at the same time."

"Funny is funny. On television, in a nightclub, in the theater, movies, no matter where, funny is funny. And the key is the audience. You're funniest when you use the audience.

"I use the audience as a barometer. I listen to 300 people, and I can *hear* whether they laugh or don't laugh; so I don't need subjective opinions about what's funny.

"The three-camera technique gives me the best chance to be funny, because I always have three cameras looking at *everything.* I don't have to pick the very best shot until later in the quietness of the editing room. Then I can listen to the audience, see where they laughed, and pick the funniest shot. For me it works better than picking the shots electronically as you shoot.

"The three-camera technique involves lots of rehearsal. We're often rewriting up to the very last moment. I have even rewritten lines in front of the audience. I welcome contributions from anybody in my shows, because comedy can come from any place. Many of my cameramen have given me funny lines. Gate guards have contributed. The more creative the atmosphere, the better.

"I think film is kind to performers. It's *much* kinder to women; it makes women look prettier. This may be due partly to the subtler lighting and partly the nature of film. At any rate, my gang is pleased with how the film camera treats them.

"About 86 percent of prime-time television originates on film. The *look* of film may have something to do with this.

"I don't use a laugh track but even using a live audience can be bad. A number of my shows have featured cult heros; so when a Fonzie or a Mork makes an entrance, the audience stands up and cheers. That distracts the viewing audience from the story, so we take that out.

"Part of the appeal of series television is *comfort.* It makes people comfortable to see the same familiar faces each week, doing different kinds of things, but remaining in character. It's like having friends. If you make your series a best friend, you can put it in that wood frame, and it will last for seven years."

If you would like to receive our publication for filmmakers, Kodak Professional Forum, write Eastman Kodak Company, Dept. 640, 343 State Street, Rochester, NY 14650.

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WHAT'S NEW

IN PRODUCTS, SERVICES AND LITERATURE

18' CAMERA CRANE NOW AT IDI

Image Devices Incorporated has purchased an 18' motion picture/video camera crane, which will be available in the Miami and Atlanta rental departments of the company.

The Universal Camera Crane was built by the late Art Brooker for Universal Studios in Hollywood, and Image Devices recently bid successfully to become the current owner of this unique and desirable piece of production equipment.

The IDI Universal Camera Crane has a lens height of 18 feet (up to 21 feet with extra risers). Automatic hydraulic leveling can be achieved in 10 seconds, and hydraulic friction locks for pan and tilt are incorporated. A 4-wheel drive gearbox helps move the crane over rough terrain, and an extra high-low transmission gear selector gets the unit anywhere, under any conditions.

The crane has four-wheel partial crabbing, combined with a 10 mph electric motor drive, which are very useful on the soundstage for silent operation.

The IDI Universal Camera Crane can pan 360 degrees, and has a side reach of over 12 feet. A geared turret head combined with a lighting and umbrella t-bar and 3 cushioned seats enable this crane to handle any job that comes up.

For operator convenience, there are three remote control solenoid panels. One in the driver's compartment, one on the front of the crane arm, and a third on the back of the arm.

The crane can travel at highway speeds of up to 55 mph, and a powerful Chevrolet gasoline V-8 engine is easy to maintain.

Image Devices' technical staff is busy setting up an intercom communications system for the crane which should be available in a few weeks.

The IDI Universal Camera Crane is available for feature films, commercials, T.V. movies, public affairs and any production situation. Rental rates can be had by calling the IDI office nearest you.

Image Devices Incorporated—Miami; 1825 NE 149th Street; P.O. Box 61-0606; Miami, Florida 33181; 305/945-1111.

Image Devices Incorporated—Atlanta; 1651 Phoenix Blvd.; P.O. Box 490250; Atlanta, Georgia 30349; 404/996-0000.

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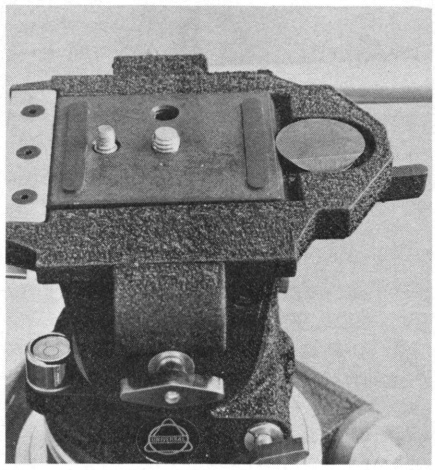

NEW UNIVERSAL TRIPODS

The new Model U/8-SL-P is a valuable addition to the extensive range of lightweight Universal fluid head tripods for the professional cinematographer.

Although the second lightest fluid head in the Universal stable, the new Model U/8-SL-P suffers no loss in rigidity and also incorporates a new low-profile snap lock system. Camera lock-off capability is rated at 16 lbs (8 kgs.).

All Universal fluid heads are Australian-made and carry a 3-year after sale warranty and are distributed solely by the John Barry Group throughout Australia and New Zealand and most of South East Asia.

The range of Universal tripods is especially appreciated by movie cameramen with its auto-slip for quick free-pan movement which is totally automatic.

Universal tripods are manufactured under the strictest quality control and are constructed of wood and aluminium. Their rugged design makes them ideal for use on location in any kind of terrain—in mud, snow or rain and they are therefore invaluable to TV news crews, newsreel teams or anyone in the film production field using lightweight video cameras.

All sales and service enquiries can be made to any John Barry office in Sydney, Melbourne, Perth, Wellington and Auckland.

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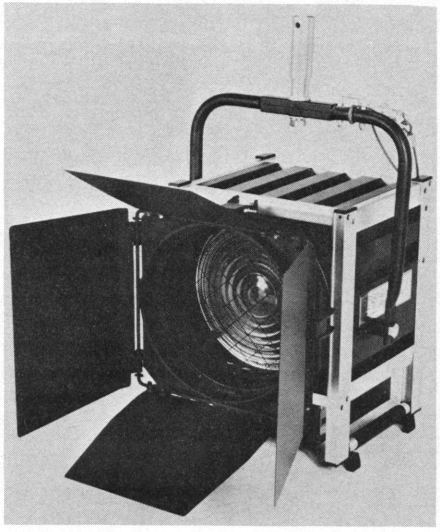


NEW RDS/HMI FRESNEL SPOTS AVAILABLE FROM CINEMA PRODUCTS

Cinema Products Corporation (Los Angeles) has been appointed the exclusive distributor for North and South America of a new line of HMI lights for motion picture and television production manufactured by Ryudensha Co., Ltd. (Japan)—one of the largest manufacturers of professional lighting equipment in the world.

First introduced at the 1979 SMPTE Conference in Los Angeles, the new RDS/HMI Fresnel spots have generated a great deal of excitement because of the many design innovations they feature. They have since been used on numerous occasions, most notably to light a number of events at the recent Winter Olympics at Lake Placid.

The new RDS/HMI lighting series consists of four units: 575-watt, 1200-watt, 2500-watt and 4000-watt daylight-balanced luminaires, each with its own ballast designed to operate at 120 volts, 60 Hz.

Outstanding features include:

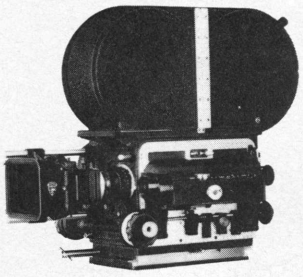
—A Fresnel lens specifically designed by Ryudensha to provide the RDS/HMI lights with a more efficient optical system resulting in a smoother field of light, as well as a wider focusing ratio from spot to flood.

—The basic modular construction permits safe, convenient changing of lamps

Continued on Page 596

USED CAMERA SALE

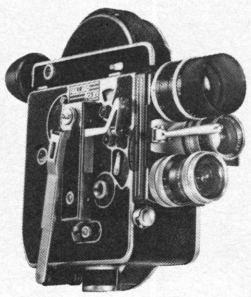
Professional 16mm and 35mm Motion Picture Equipment



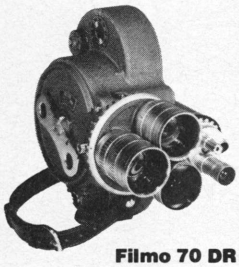
Mitchell BNC

Arriflex BL

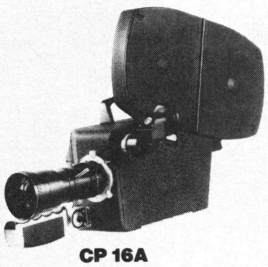
Arriflex 16S



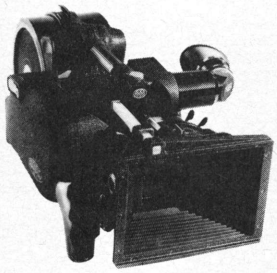
Bolex Rex



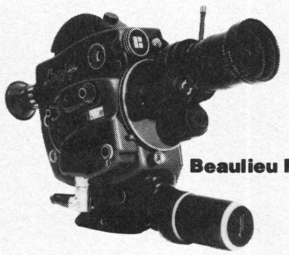
Filmo 70 DR



CP 16A



Arriflex 35 BL



Beaulieu R16

35mm CAMERAS

	Sale Price
Arriflex 35 II CB Camera Package two 400′ mags., constant motor, power cables, battery 28mm, 50mm, 75mm Schneider lenses & case. Used. Excellent	$10,500.00
Arriflex 35 II C Camera Package: two 400′ mags, constant speed motor, cable & case. Rebuilt	$9500.00
Arriflex 35 2B w/ V/S motor, 2 400′ mags, 35, 50 75mm Baltar lenses	$3995.00
Arriflex 35 2B w/ V/S motor, 2 400′ mags, 32, 50, 85mm Zeiss lenses	$3995.00
Arriflex 35 2/BV w/2 400′ mags and variable shutter. Like New! New Price $12,800	$5500.00
Bell & Howell 2709, Camera body w/Mitchell type L base rackover. Rebuilt. Excellent	$4995.00
Bell & Howell Eyemo Q-body only	$ 795.00
Mitchell BNC camera pkg. including 4 Baltar lenses (25mm T2.5, 35mm, 50mm T2.5, 75mm T2.5,) 4 1000′ mags, viewfinder, 220v 3 phase motor, cases	$19,500.00
Mitchell Standard rackover w/4 Cooke Speed Panchro lenses (28mm, 40mm, 50mm, 75mm), 400′ mag. and motor	$3800.00
Mitchell NC Reflex, rebuilt and excellent condition.	$7500.00
Mitchell NC S/N 535, matte box, 400′ mag, 110v AC/DC motor, viewfinder, 3 lenses	$6200.00
Mitchell Triangulation Camera	$5500.00
Triad Photo-Aid Eequence Camera (12-48 fps.)	$1250.00
Arriflex 35 II "B" Body Only, completely rebuilt	$1995.00
Arriflex 35 BL w/ one 200′ & one 400′ mag, 16, 24, 32, 50, 85mm Zeiss Lenses and Scales. Lens blimp, matte box, cable, battery & cases	$52,500.00
Mitchell 70mm FC Body Only	$10,500.00

16mm CAMERAS

	Sale Price
Arriflex 16S w/ V/S motor, 10mm, 25mm, 50mm Schneider lenses, battery, matte box	$4995.00
Arriflex 16S w/ V/S motor	$2100.00
Arriflex 16S w/ V/S motor, cable, 11.5mm 16mm, 25mm Schneider lenses, battery belt	$4995.00
Arriflex 16SB w/ V/S motor, 2 400′ magazines, torque motor, and case	$5995.00
Arriflex 16BL w/Zeiss 12.5-75, matte box, 1 400′ mag, battery, cable, case. Very Good	$8295.00
Arriflex 16BL, 12-120 Ang., 2 magazines. Excellent. Late model	$9500.00
Auricon Cine Voice w/ 25mm Soligar	$ 895.00
Auricon CM-74G Pro 1200 w/Ang. 12-120 w/ 12″ VF, 2 1200′ mags, MA-11 amp., case	$3750.00
Auricon CM-75 Pro 600 w/ 600′ mags, MA-11amp, case	1950.00
Auricon CM-75 FM, auto-parallax blimp shade, aux door, case	$ 895.00
Auricon Cine Voice Conversion body only	$ 995.00
Mitchell 16 Body w/400′ mag	$3500.00
Kodak Cine Special I w/mag, VF, 63mm Ektanon, 102mm Cine Kodak lenses	$ 695.00
Kodak Cine Special I w/mag	$ 550.00
Kodak Cine Special w/two 200′ mags, 15mm, 75mm, 63mm, 152mm lenses	$1095.00
Kodak Cine Special w/electric release remote control	$1195.00
Bell & Howell Spyder w/12v DC motor, 2 400′ mags., w/ 10, 25, OBJ lenses, 10mm Ang., 25mm f0.95 Ang. compartment case. Like New	$2495.00
Bell & Howell 70S Hi-Speed (128 fps) w/sports finder, 1″ Cine Raptar	$ 795.00
Bell & Howell Traid 77 Filmo MOD w/204° shutter, 25mm Ektar	$ 495.00
Bell & Howell 70DR body only. Demo	$ 695.00
Beaulieu R16PZ w/Ang. 12-120, handgrip 1000 MA battery, charger, 200′ mag, case	$2995.00
Beaulieu R16 body only	$ 795.00
Mauer Model J camera, B-M VF, 24 fps motor. As is	$1795.00
Mauer B-M Silent Pro camera, 24 fps motor, 400′ mag	$2150.00
Milliken DBM 4C Hi-Speed camera w/Ang. 12-120	$3695.00
Benson Lehner 28v 16DZ (200fps) w/bore sight	$1900.00
Fairchild HS101 Hi-Speed camera 3000/8000 fps, 9/60v DC w/ 3″ Elgeet, motor, power supply control box	$1995.00
Bell & Howell 70 HRs w/reconditioned bodies	$ 495.00
Bolex Rex V w/26mm f/1.1 macro Switar. $4054.00 new. Like new	$2200.00
Bolex Rex V w/rex-o-fader 40, 75mm macro Switar and case. $4444.00 new. Like new	$2250.00
CP 16A sound camera w/ crystasound amp., mag. head, 2 ea. NC-4 batteries, 2 ea. NCC-6 chargers, 2 ea. 400′ Mitchell mags., 12-120mm AV Zoom lens & case. New Price $12,340.00. Rebuilt	$7200.00
Fastax WF-3. 100′ capacity w/powerstat	$2350.00
Fastax WF-4, 400′ capacity w/powerstat	$2995.00
Bolex Supreme w/17 to 85 Pan Cinor, case & misc. access. Excellent	$ 795.00
Maurer 05 w/ one 400′ mag., 110 v/s motor	$1995.00
Cine Special Animation Camera w/motor. Special modification by Oxberry	$ 895.00

CAMERA ACCESSORIES

	Sale Price
Mitchell Matte cutter	$ 295.00
Leitz focusing bellows	$ 195.00
Mitchell timing block	$ 125.00
Mitchell I-L viewfinder	$ 750.00
Jagabi speed indicator	$ 325.00
Cine Special microscope attachment	$ 75.00
Cine Special adapter block for animation motor	$ 85.00

MAGAZINES

Cineflex 400′ mag	$ 95.00
Mitchell 35mm x 1000′	$ 175.00
Mitchell 35mm x 400′	$ 195.00
Bell & Howell 35mm x 400′ fiber	$ 40.00
Bell & Howell OD 35mm x 200′ fiber	$ 20.00
Bell & Howell 2709 Bilateral Bi-Pack	$ 795.00
Mitchell 35mm x 400′ Bi-Pack	$ 495.00
Cameflex 35mm x 400′	$ 450.00
Mitchell to B&H base adapter	$ 195.00
Mitchell 16mm x 1200′. New Price $950.00. Used	$ 500.00
Mitchell 16mm x 400′ mags. New Price $350.00. Used	$ 160.00

MOTORS

NCE C.V.B. V/S motor w/Cine Kodak adapter	$ 350.00
Mitchell single system sound 24v DC motor	$ 595.00
Arriflex 16BL 12v governor motor	$ 495.00
Mitchell Mk II V/S DC motor, 2-350; 16-32 fps	$ 695.00

BLIMPS

Arriflex 16 Fibre blimp M	$1500.00
Arriflex 16S blimp, complete	$1250.00
Model 600-A Ceco blimp	$ 300.00
Mitchell Mk II blimp	$4500.00
Kodak Cine Special blimp	$ 295.00
Mauer 05 blimp	$ 995.00

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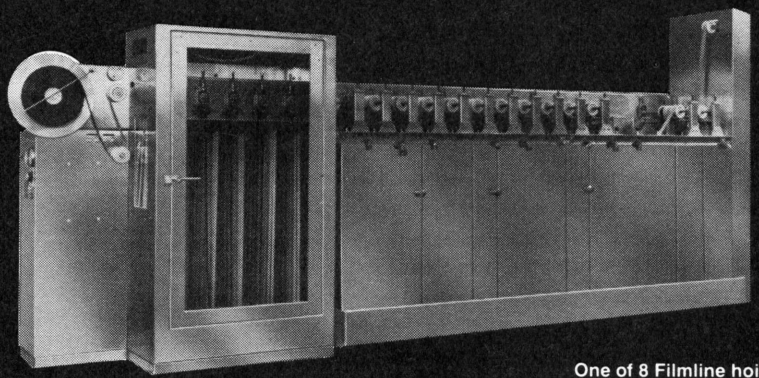
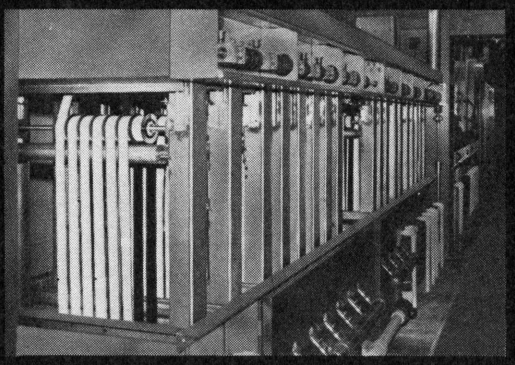


Typical medium size Filmline processor available in speeds from 7-200, F.P.M.



One of 8 Filmline hoist-type processors installed at Technicolor, Hollywood, California running in excess of 400 F.P.M. (Hoist shown partially raised.)

Micro-Demand is a patented exclusively different concept in demand drive film transport systems.

Micro-Demand is a dynamically tension-controlled friction film transport system that operates effectively at minimum tension and with complete reliability. When used with Filmline Feather-Touch film spool "tires" it transports 35mm, 16mm and single strand 8mm film interchangeably and without adjustments even when these films are spliced back-to-back.

Once optimum tensions are set there is no need for further adjustments, yet the design allows easy and rapid, dynamic adjustment of film tension while the machine is running.

Micro-Demand has a broad band of self-compensation, is of functional construction and requires minimum maintenance.

There are no fragile, plastic spring bushings, no wobble rollers. No elaborate articulations of any type. Just sound engineering and the highest quality materials and workmanship.

No other competitive processor or film transport system commercially available has ever achieved the operational speeds and proven reliability of Filmline Micro-Demand Processors.

SIGNIFICANT MICRO-DEMAND FEATURES:

Versatility	Any speed, any process.
Reliability	Rugged construction, quality materials and sound engineering. Always ready when you are!
Flexibility	Any format 35mm, 35/32mm (1-3), 35/32mm (1-4), 35mm 5R S8, 16mm — 70MM-105MM etc.
Dependability	Can stand the gaff of long, continuous, top speed runs with "Zero-down-time."
Credibility	Ask the labs who own them. Most of them own not one but several.
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Performance	Every Filmline machine is backed by a superb performance record compiled in over 25 years of continuous service to the industry. Twenty five years in the forefront of processing machine design and innovation.

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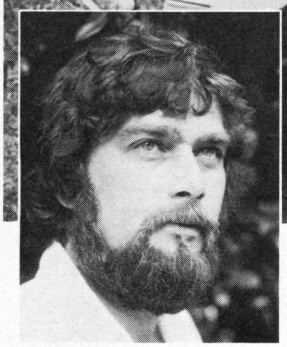
Associate Producer/Production Manager

JIM RAGAN on filming "SCOUT'S HONOR"



...with equipment from CINE-PRO.

And here is Jim Ragan's evaluation: "My first experience with Cine-Pro has been in the production of 'Scout's Honor'. I can tell you it surely won't be the last. The service they've given us bears out what I've heard about them for years; they really *do* put themselves out to make sure that a production has exactly what it needs, in perfect operating condition, precisely when and where it is needed. That isn't just during 'regular business hours', either. If something is needed in the middle of the night, they're right there with it as ordered. No reluctance, delays or excuses, no air of doing one a 'big favor'. If they don't happen to have on hand exactly what you want, they don't push some substitute or make you waste valuable time calling around to try to find it; they get it for you and deliver it fast. And I haven't had a single complaint about their equipment from anyone on the crew. In a business where just a half-hour delay can cost a production thousands of dollars, the value of Cine-Pro's kind of unfailing service has to be appreciated and remembered for the next time . . . and the next . . . and the next."

There can be little doubt that as associate producer/production manager of the currently filming "Scout's Honor", a two-hour Movie of the Week for NBC, Jim Ragan will add to a rapidly growing reputation as one of the most thoroughly competent and fastest-rising young men of the motion picture industry. Jim studied acting at Chicago's distinguished Goodman Theatre and performed professionally for five years. He also gained recognition as a talented photojournalist and moved with natural ease to motion pictures as an assistant cameraman and, later, director of photography. In 1978, he was assistant director and production manager of Saul Bass's Academy Award nominee, "Notes on the Popular Arts". More recently, he has won favorable attention as assistant director on "The French Atlantic Affair" for MGM, as associate producer/production manager of six National Geographic specials, a five-part mini-series for CBS, and many other outstanding films.

"SCOUT'S HONOR"
A ZEPHYR PRODUCTION
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for NBC-TV

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Supervising Producer:
Nancy Geller
Producer:
Jim Begg
Associate Producer:
Jim Ragan
Director:
Henry Levin
Assistant Director:
Denny Salvaryn
Second Asst. Director:
Ken Stringer
Production Manager:
Jim Ragan
Director of Photography:
Gary Graver
First Asst. Cameraman:
Bruce Pasternak
Second Asst. Cameraman:
Vince Baldina
Gaffer:
Jono Kouzouyan
Key Grip:
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▶ Oxberry 16mm Filmaker Stand with 400′ Mag., 35mm Camera Head, 28mm 55mm Lenses, Autofocus to 1:1, Time Exposure, Hand Jog Unit, 12 Field Platens, Animation Table Top, Top and Bottom Light Units, Rotoscope, 35mm Slide Holder Approximate New Price $30,000.00	Used $15,000.00

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THE BOOKSHELF

By GEORGE L. GEORGE

DATA SOURCES

Richard Roud, a director of the New York Film Festival, has assembled in CINEMA: A CRITICAL DICTIONARY intelligent and authoritative evaluations of the world's leading filmmakers, national cinemas and film genres by such international experts as Noel Burch, Andrew Sarris, Penelope Houston, Hames Monaco, Tom Milne and Roud himself. This is a major contribution to film reference literature, a solid body of critical analysis that encompasses the history of film in all its manifestations (Viking, 2 vols. $75).

Some 12,000 films are listed in HALLIWELL'S FILM GUIDE (2nd ed.), an invaluable record and assessment of world film production of the last 50 years. Under Leslie Halliwell's practiced and erudite guidance, the book offers full credits, plot synopses, a valid film rating system and occasional quotes from critics' reviews (Scribners $36).

In FILM SUPERLIST FOR 1940-1949 MOTION PICTURES IN THE U.S. PUBLIC DOMAIN, some 20,000 films whose copyright has expired have been compiled by Walter E. Hurst, Johnny Minus and William Storm Hale, a potential bonanza for alert operators (Seven Arts Press, Box 649, Hollywood, CA 90028; $95).

Requirements of the AV industry are well served in the 10th edition of AUDIOVISUAL MARKET PLACE 1980. AV hardware equipment manufacturers and dealers, AV software producers and distributors, and service firms are listed in this reliable multimedia guide, as well as numerous ancillary facilities and other relevant data (Bowker $29.95).

In TEXAS PRODUCTION MANUAL, existing film/TV services appear in an extensive listing of facilities and personnel (Texas Film Commission, Box 12428, Capitol Sta., Austin, TX 78711; free to qualified individuals and firms). Similar facilities in the Chicago area are listed in CU DIRECTORY (203 N. Wabash Ave., Chicago, IL 60601; $5).

In REEL CHANGE, Patricia Peyton effectively catalogs some 500 movies dealing significantly with human values, community involvement and ethnic pride (N.Y. Zoetrope $6.95).

★ ★ ★

ASPECTS OF CINEMA

In THE MUSIC OF MAN, television producer Curtis W. Davis and violinist Yehudi Menuhin write about the 8-part series shortly to be seen on public television. The book describes in an insightful and enlightening way a fascinating journey through musical history told in an attractive large format, superbly illustrated volume (Methuen $24.95).

Film critic Pauline Kael assembled in WHEN THE LIGHTS GO DOWN her reviews from The New Yorker, displaying her remarkable knowledge of the medium and its techniques, an enormous erudition, and a healthy penchant for controversy (Holt Rinehart Winston $18.95/9.95). Novelist Graham Greene's film criticism, written in the '30s for British periodicals, are reprinted in THE PLEASURE DOME, an enjoyable collection, both perceptive and openminded (Oxford U. Press $8.95).

John Robert Colombo has gathered in POPCORN IN PARADISE what he aptly calls "the wit and wisdom of Hollywood," some 3000 quotes from 700 movie personalities trading aphorisms, epithets and smart aleck one-liners about life in the movie colony and their stake in it (Holt Rinehart Winston $9.95).

In STAR BABIES, Raymond Strait writes up case histories of children of top Hollywood performers, revealing the heartbreaks and frustrations that beset these youngsters when years of glamor and affluence came often to an abrupt end (St. Martin's $10.95).

★ ★ ★

TALENT ON PARADE

A thoughtful, detailed and erudite study by Prof. Alexander Sesonske, JEAN RENOIR: THE FRENCH FILMS 1929-1934 is greatly indebted to the author's long acquaintance with the director. It analyzes with rare sensitivity a significant period in Renoir's oeuvre during which his films evolved from the experimental to the full flowering of Renoir's cinematic mastery (Harvard U. Press $25/9.95).

A new volume in G. K. Hall's excellent Guides to References and Resources series, ARTHUR PENN by Joel S. Zuker presents a thoroughgoing study of the director's career. It includes a complete biography and filmography, a critique of his work, an archival catalog of his films, and other related data ($22.50).

A seminar with Werner Herzog, the German director of the recent *Nosferatu* is reprinted in IMAGES AT THE HORIZON. It is an enlightening document that reveals Herzog's approach to realism, his striving for a stylized manner and, particularly, his artistic extremism as an aspect of purity (N. Y. Zoetrope $4).

Ted Morgan's compelling biography, MAUGHAM, is a superbly researched study of the author whose *Of Human Bondage, Rain* and many other works were made into successful movies. Despite the acclaim, Maugham's opinion of cinema was low, and he used to complain about directors distorting his ideas (Simon & Schuster $17.95).

In THE FIVE LIVES OF BEN HECHT, Doug Fetherling examines the life and career of the writer whose numerous screenplays—from Stroheim's *Underworld* (1927) to Huston's *Casino Royale* (1967)—are considered among the most inventive blendings of image, plot and dialogue (N. Y. Zoetrope $11.95).

Was Errol Flynn a Nazi spy? Charles Higham strongly infers so in ERROL FLYNN: THE UNTOLD STORY, using many declassified CIA and FBI documents. Intriguing and highly readable (Doubleday $12.95).

In REFLECTIONS, Ricardo Montalban (with Bob Thomas) offers a refreshing memoir of "life in two worlds," a successful mix of devotion to family and religion with a busy career (Doubleday $8.95).

Dorothy Lamour's autobiography, MY SIDE OF THE ROAD (as told to Dick McInnes), is an easygoing narrative, entertaining but by far less revealing of her personality than the sarong of her physique (Prentice-Hall $12.95).

Model/actress Dorian Leigh, sister of model/actress Suzy Parker, bemoans in THE GIRL WHO HAD EVERYTHING (written with Laura Hobe) how she foolishly mismanaged her career and turned to religion as a last resort (Doubleday $10.95).

Equally expert with camera and pen, Sam Shaw presents BRANDO and THE JOY OF MARILYN, attractive portraits that combine lively comments with striking candid shots of two highly dissimilar stars (Bookthrift $7.98 ea.)

Charles Shows evokes in BACKSTAGE ADVENTURES WITH WALT DISNEY his decade with the studio as produder, director and writer (Communication Creativity $10.95). ■

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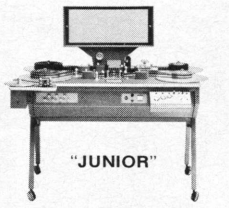

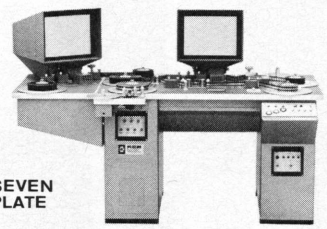

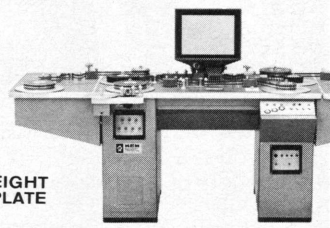

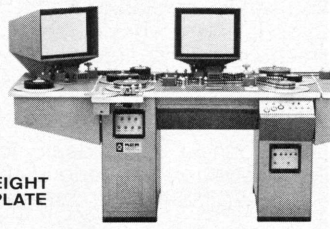

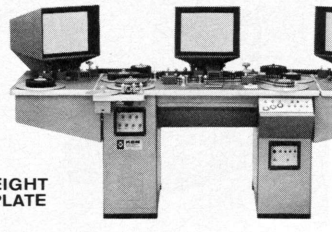

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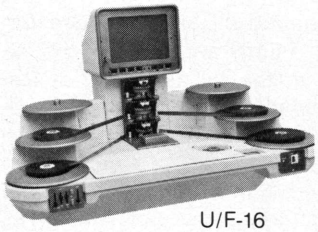

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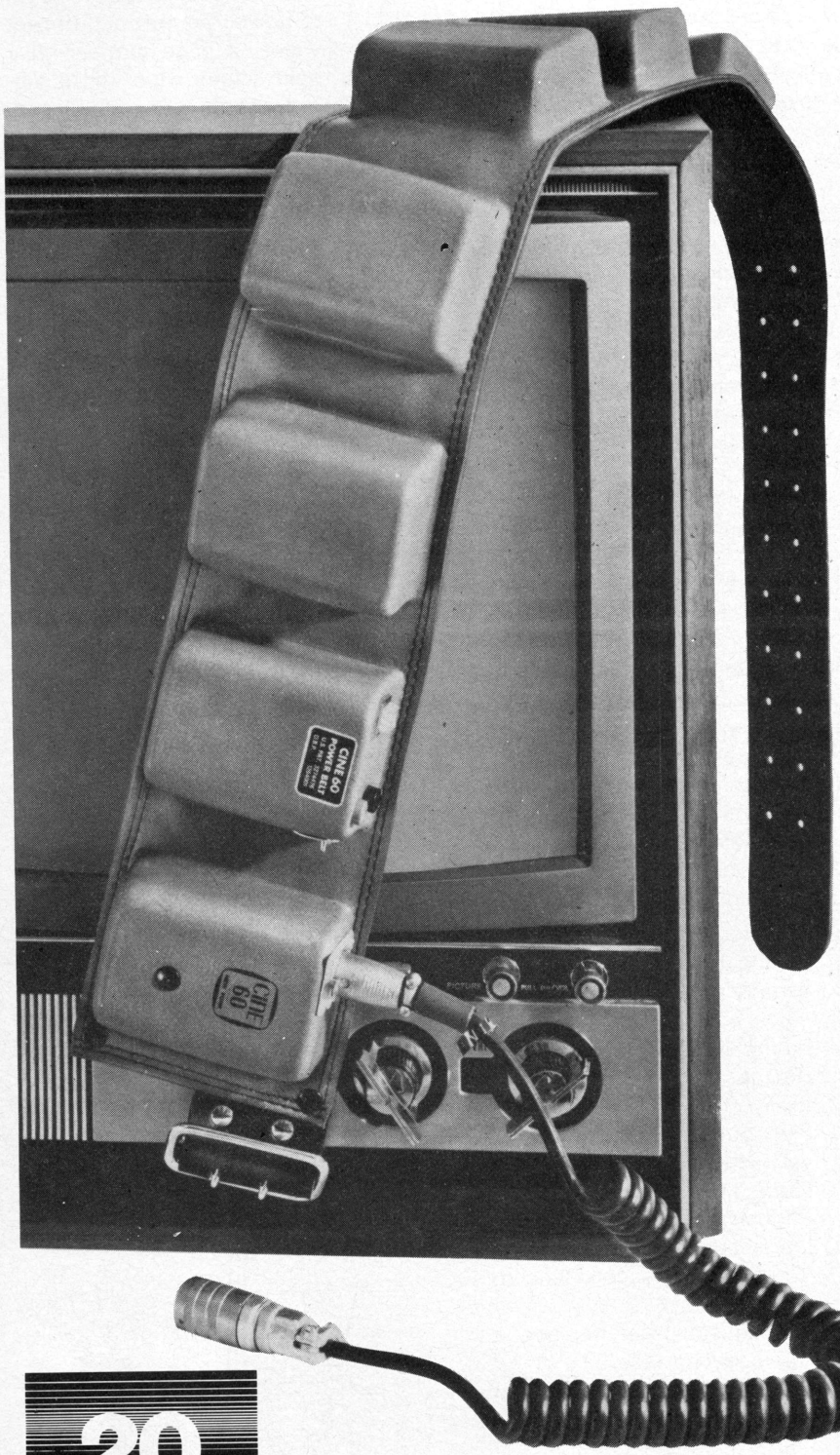

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CINEMA WORKSHOP

By ANTON WILSON

VIDEO VS FILM POST PRODUCTION

Once a film person begins working with video two things are quickly realized: one, a 19" box is not quite the same thing as Panavision 70 at the Ziegfeld and two, video technology is a slight step ahead of Moviolas and clapsticks. While the world of video may seem cold and electronic, a newcomer to video quickly learns that this technology can be utilized to one's creative and financial benefit. We have seen how the video cameraman can manipulate the many controls in the video cameras to create an unlimited array of visual subtleties. It has been my experience that most film cameramen enjoy working with video once they have become familiar with the creative possibilities. However it is in post production that the video process really shines. The major advantages of video post production became quite clear to me recently when two of our productions went into editing at the same time. One was filmed and the other was video. The details of the saga may prove illuminating.

The 16mm film project was for IBM. It was approximately 15 minutes long and the subject was the introduction of a new computer. The video project was an employee motivation tape for AT&T of about the same length. First the film project, I am sure that the story will sound familiar.

—The creative aspects of the rough cut have been finished; now we have to work on the supers, titles, credits and opticals.

—The client was quite precise as to the size, shape and color of the title, especially the log. All morning is spent with the graphic artist at the effects house going over details.

—Next day another trip into the city to approve the artwork before it is shot. Changes are made and the art work goes to the camera.

—Two days later, into the city to check the titles and supers; no good. The positioning is off as well as the colors. I wanted orange and the color was too yellow. Moreover, the supers did not "pop" onto the screen at the right time. The camera operator admitted it was his error and he would try again. Come back in two days.

—A week later all titles and supers are approved. The original goes to the negative cutter for A and B rolls.

—Next day a call from the negative cutter. He is not sure about one scene, would I come over.

—Two days later the A and B rolls go to the lab for timing and first answer print.

—Three days later first answer print is ready. Despite explicit instructions and directions it is no good. Color balancing is not perfect. One group of scenes that was supposed to be darkened dramatically was printed up, and one or two of the dissolves did not work well (our fault).

—Four days later, second answer print; not perfect but okay.

—Four days later first answer print from CRI.

—Final result, after almost four weeks and more than a half-dozen trips into the city (not to mention four million gray hairs), we've got a product that is still a compromise, but it does get client approval.

While the foregoing melodrama was ensuing, I found one day to get our AT&T project into the video editing room. This relaxing, clean and modern facility included a CMX computer editor, a Chyron character generator, a Quantel digital effects generator and a CDL 480 switcher, all built into one console. The dialog went something like this:

EDITOR: How do you like this type face for the title? (Shows me title *already* supered on the scene.)

ME: A little bolder and make it lower on the screen.

ED: (Pushes a few buttons) How's this?

ME: Fine, but the green color is too yellowish.

ED: (Turns knob) How's this?

ME: Perfect. Now fade the title in; four-second fade in.

ED: (Executes four-second fade in) How's that?

ME: A little slow. Let me see a three-second fade.

ED: (Does three second fade) You like?

ME: Looks good. Let's do it.

ED: (Presses edit button) Next?

Later

ED: What about the transition into this next scene? Instead of a dissolve, how about a wipe?

ME: What did you have in mind?

ED: (Shows me three different wipes, a page turn, a multi-split screen wipe and a flip-out, each with the actual scenes involved so that I can evaluate exactly how it will look.) Which one?

ME: I like the page turn, but can you speed it up?

ED: (Turns knob) How's this?

ME: Do it!

Later

ME: This scene looks a little bright and pale.

ED: (Turns down video level, turns up chroma on TBC) How's this?

ME: A little more color saturation but not too much red.

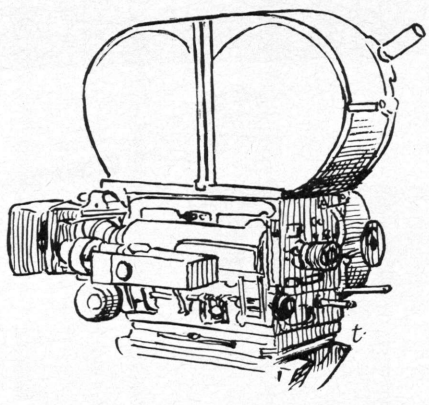
ED: (Turns knobs) How's that?

ME: Okay

Similar dialog continues.

Results of video edit: In one day (10 hours) I have an edited master and dub, the equivalent of a CRI and first answer print from CRI. In one day I have a perfect product with almost no compromises, complete with titles, credits, supers, sophisticated opticals and sound mix, not to mention perfectly timed and color corrected (and no gray hairs).

I am convinced that I have achieved superior results in one-twentieth the time that would have been required had this production been done on film. Agreed that the project would have had more impact as a film on a large screen. However, once the client stipulated video distribution, doing this project in video was the only way to go, both creatively and financially (and it's easier on the ulcers). ■

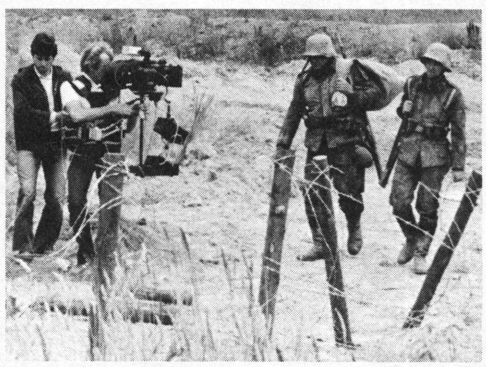


"On the Western Front" with Steadicam...

A CBS Television Network presentation on the Hallmark Hall of Fame, Norman Rosemont's production of Erich Maria Remarque's "ALL QUIET ON THE WESTERN FRONT" has already been critically acclaimed as a classic in its own right. It was recently honored with a Golden Globe Award for "Best Motion Picture Made For Television."

The use of Steadicam was of paramount importance in filming the six million dollar three-hour production, with a tight shooting schedule of 46 days (which director Delbert Mann managed to shave down to a record 41!).

"Steadicam was of tremendous help to us," says producer Rosemont. "Our trenches were dug to German military specs, and were very narrow. With Steadicam we were able to get down into the trenches without laying any track."



Steadicam operator (using Arri 35BL) "captures" stars Ernest Borgnine and Richard Thomas trudging away from the battlefield.

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The Tyler Gyro Head unit can be fastened directly to the deck of a boat, to a tracking vehicle, to a tripod or dolly—or it can even be dangled from a crane.

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Samuelsons of London have just taken delivery of the first production unit, and already it is in use on the Mediterranean unit of the new Disney picture *Condorman.*

The prototype unit already has an impressive string of credits behind it—*Jaws 2, Orca, Killer Whale, King Kong, Grey Lady Down* and *Islands in the Stream* being among the productions on which it has been used.

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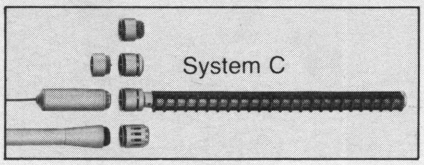

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Ira Wohl, Director "Best Boy"

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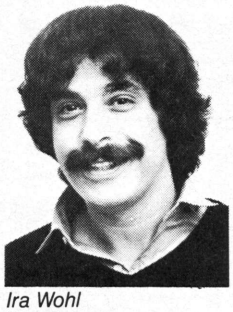
"Tom knew that Chem-Tone would give us the effect we needed because it brings out shadow details which would otherwise be lost. We were able to film with minimal lighting equipment and still get great prints.

"Thanks to Chem-Tone, we were able to capture on film a sense of immediacy and spontaneity, the drama of events as they happened. So you could say that the Chem-Tone process was absolutely essential to this film.

"In fact, TVC played a very supportive role in this project. The people there are very human, genuinely interested in helping independent filmmakers. Right from the start, they felt that 'Best Boy' was important, and did their best to make it a success."



Ira Wohl

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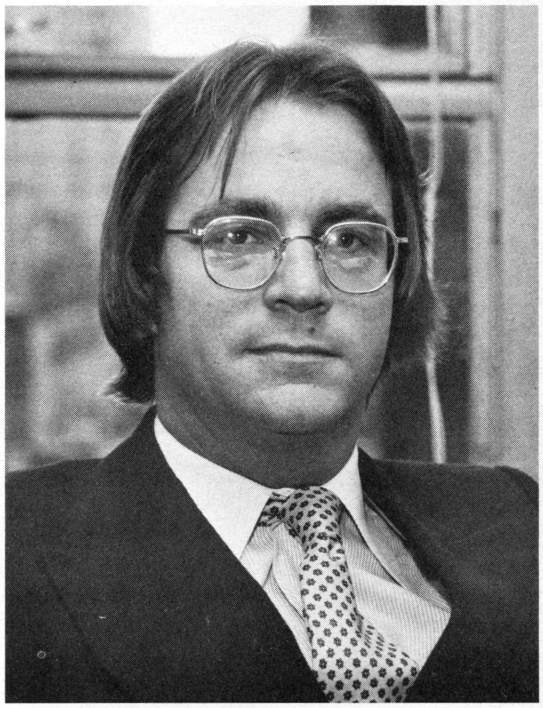

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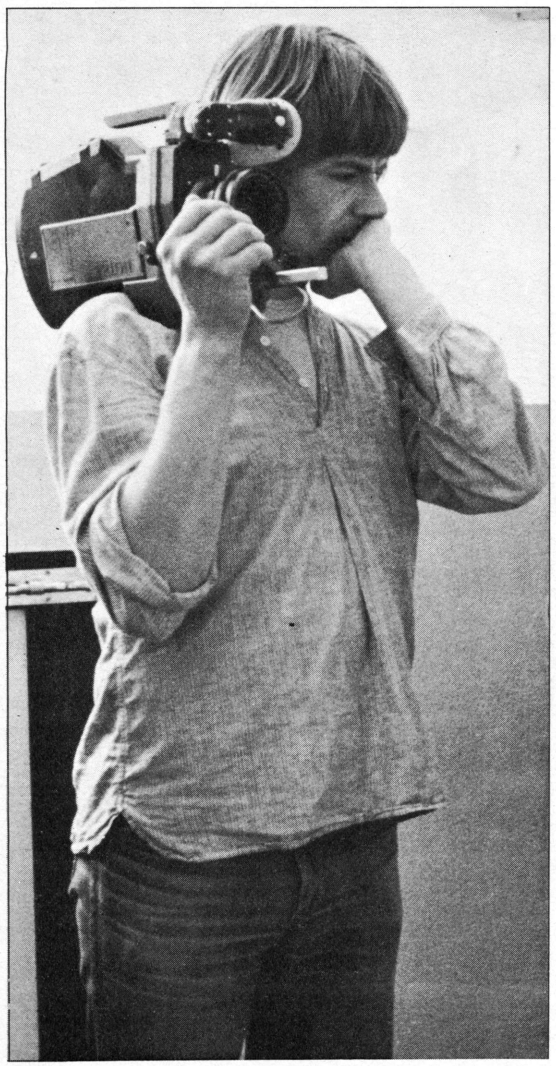

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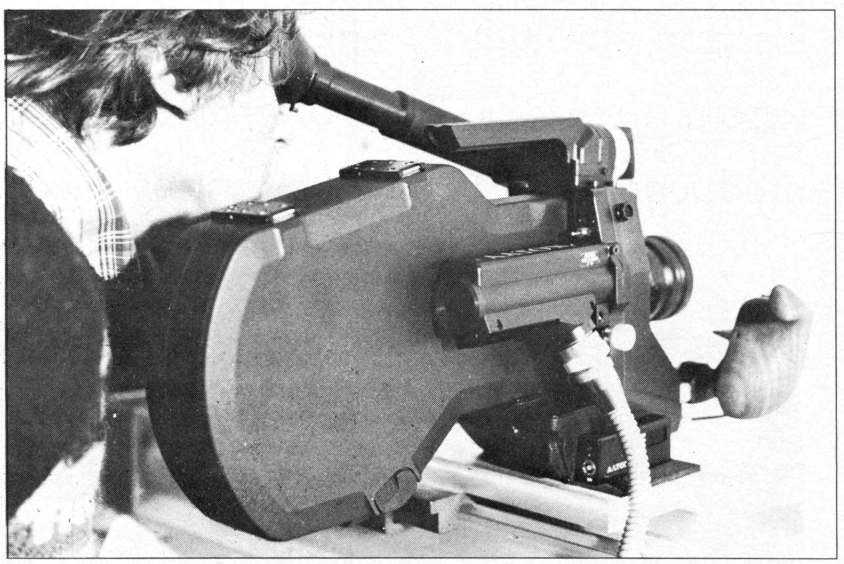
With its ergonomic design, optimum viewfinder positioning, and adjustable front handgrip, the Aaton 7 LTR 16 mm camera is a reference for handholding comfort. It is light (5 1/2 kilos) and the weight is evenly distributed.



Equipped with eyepiece extender and video tap, it is also perfectly at home on a tripod, making it an excellent studio instrument. Add to this a noise level well below 26 dB on the average, and you can see why discerning cameramen *and* directors choose Aaton.

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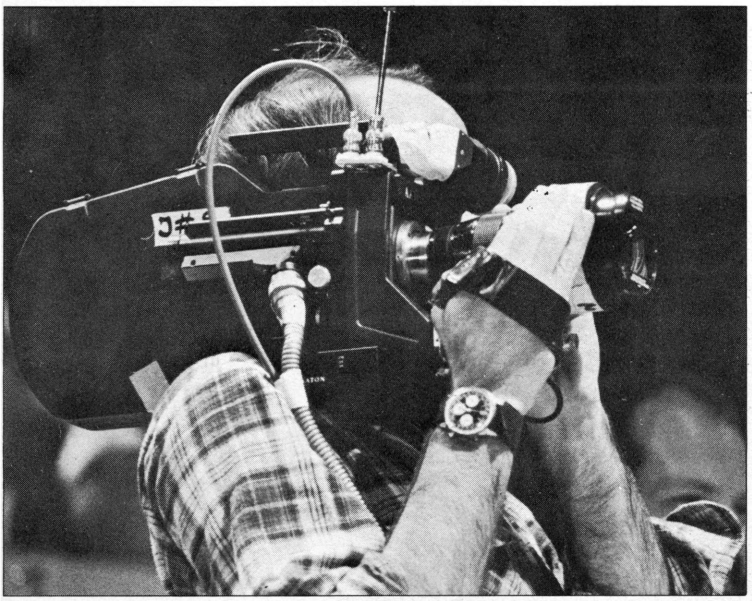

Kenneth Thorén

The usual accessories on the Aaton 7 LTR are *un*usual : instrumentation photometer with linear display to ± 2 stops; revolutionary clear time marking system; minuscule video camera niched alongside the film magazine, leaving total mobility to the viewfinder and eyepiece.

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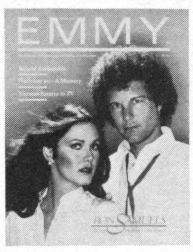

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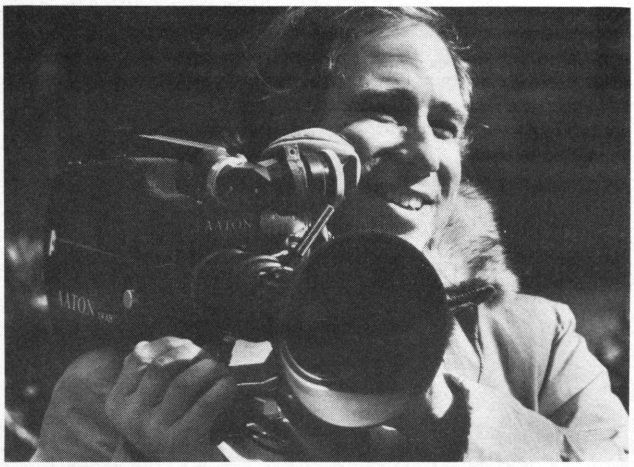
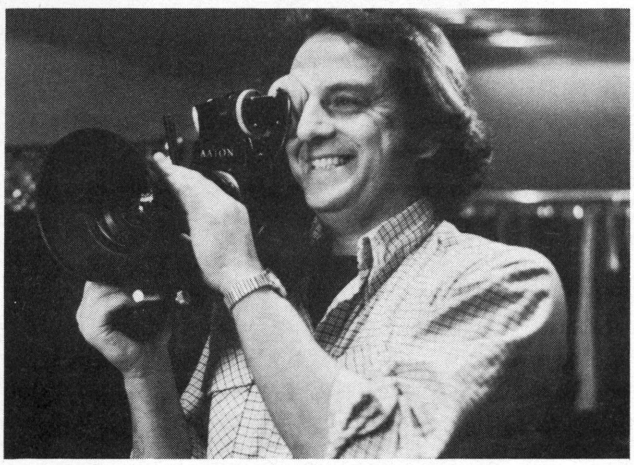


Dave Grubin on-location for "The World of David Rockefeller," the 90-minute documentary he produced for WNET's "Bill Moyers' Journal."

"The design of the Aäton LTR 16mm isn't just beautiful...it's thoughtful, too. They must have spent years analyzing the features active cameramen need. It's amazingly lightweight with a low silhouette and perfect balance, so it nestles softly and naturally on my shoulder. And it stays comfortable all day. I chose Aäton because it's as professional as you can get. And that's why I go to Zellan Enterprises for sales and service."

Greg Cooke filming another "60 Minutes" segment with his distinctive "shoot-from-the-hip style" of cinematography.

"60 Minutes is gutsy photojournalism at its rugged best, and the Aäton is making it even more exciting. The whisper quiet mechanism lets me film interviews unobtrusively in intimate settings. Outside, I can shoot comfortably holding the Aäton out of sight by my hip or balanced just by the carrying handle. And its engineering is as reliable as it is advanced. I brought the Aäton along as my sole camera to a shoot in the Saudi Arabian desert. It was like being in a sandblasting machine, but the camera held up perfectly."



Chuck Levey shooting a segment of CBS' "30 Minutes." Other assignments from the network include "60 Minutes" and CBS Reports.

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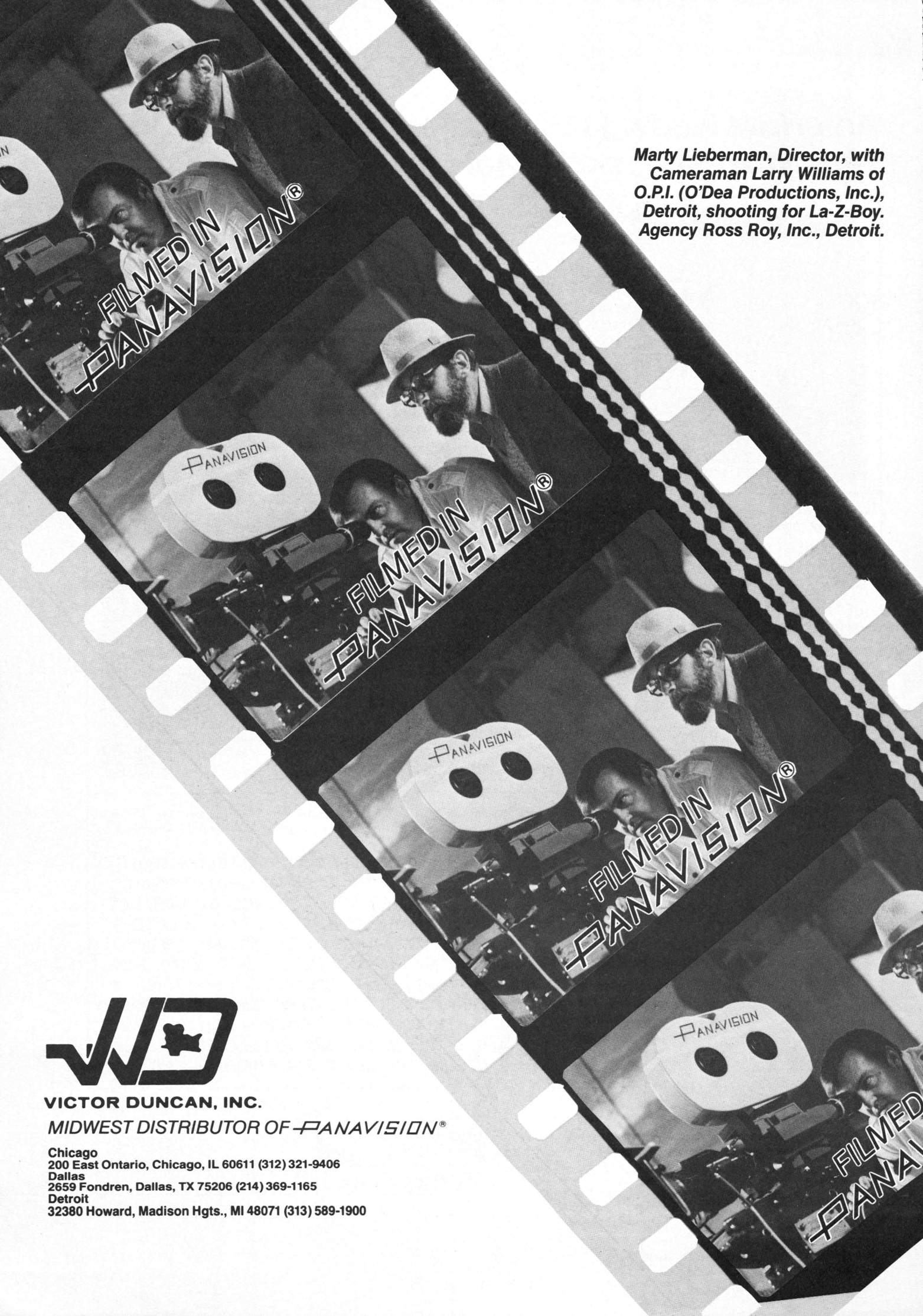

Marty Lieberman, Director, with Cameraman Larry Williams of O.P.I. (O'Dea Productions, Inc.), Detroit, shooting for La-Z-Boy. Agency Ross Roy, Inc., Detroit.

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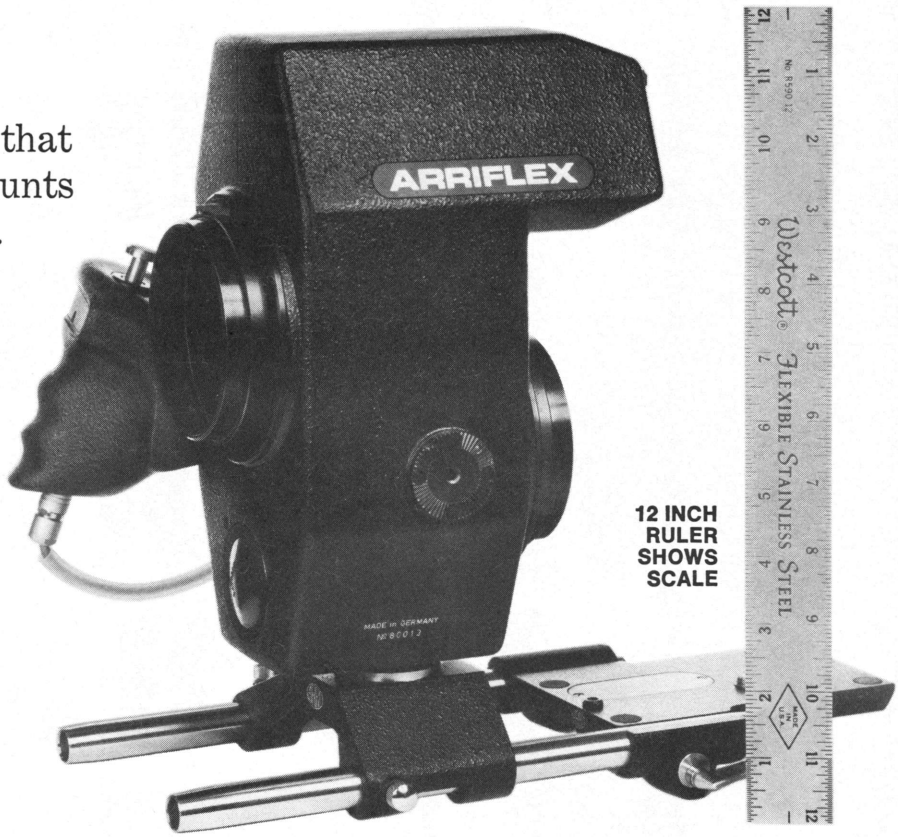

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Any tool that can make use of military and aerospace technology benefits greatly. There's the no-expense-spared design development. Exacting reliability standards. And miniaturization.

The Image Stabilizer is 9¼ inches high, weighs 5 pounds and fits into a small box – like your other camera accessories. It doesn't stabilize the camera. It stabilizes the light rays entering the lens. You operate your camera normally – looking through the viewfinder.

No special training needed. It's just another (astounding) accessory.

The Image Stabilizer comes with its own Support Plate and Bracket. You mount your camera on the Plate and position the Stabilizer in front of your lens. Switch on the Stabilizer. Switch on the camera. Shoot.

Get 3 times closer.

Without stabilization in a helicopter, you can't go longer than about the 50mm focal length on a 16mm camera. With the Image Stabilizer, you can get smooth footage at 150mm or more, depending on air turbulence.

The Stabilizer works with any prime lens longer than about 35mm on a 16mm camera – 70mm on a 35mm camera. (With zoom lenses, the shortest focal length varies slightly.) At wider angles, the Stabilizer vignettes. A small price to pay for effectively getting three times closer. And if you need a panoramic shot, that's easy: Pull the helicopter back – or take the Stabilizer off.

How it works:

The entering light rays are reflected off a front-surface mirror mounted on two gimbals powered by a battery-driven gyroscope. The mirror is effectively floating in space, as though on two trapezes – one oriented N-S, the other E-W. The image from this mirror is reflected onto another (fixed) mirror and thence into the camera's lens.

Aerospace technology.

A gyro's directional stability makes it resist off-axis movement – such as panning the camera. If you insist, it tumbles in that direction. British Aerospace, the designers, have turned this tendency to advantage. A precession brake causes the gyro to *lean with* the panning motion, steadily. This is military aerospace technology, ingeniously adapted.

The new Arriflex Image Stabilizer

works with any camera, anywhere.

The British Aerospace Steadyscope uses the same stabilization method. Above: surveillance from a NATO army helicopter.

British Aerospace is a company very much involved with high-precision technology. Military missile systems, orbital satellites...

One of their products is the Steadyscope. It uses the same gyro-stabilization as our Image Stabilizer, whose moving parts are also made by British Aerospace.

How well does it work?

In the November 16, 1978 issue of the British magazine NEW SCIENTIST, there's an article by Guy Parker on stabilized binoculars. Referring to the Steadyscope, Mr. Parker writes:

Anchored in space

"On pressing the uncage button there is an immediate transformation which is both psychological and optical. The impact is of course greater if one is being shaken in a helicopter, but even on land the image appears in an almost uncanny way to anchor itself in space, even if the instrument is deliberately jiggled about."

Detail resolution

"An optical phenomenon now becomes apparent," writes Mr. Parker. "After the initial pleasure at the disappearance of jitter, the eye seems to demand needle-sharp resolution, now that the visibility of detail is determined mainly by the quality of the optical design. *There is no future for a stabilizer which does not give the highest resolution under all conditions of use.*"

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STABILIZER SPECS:

Length (Image Stabilizer alone): 6⅝ ins. Width: 4 11/16 ins. Height 9¼ ins. Weight (Image Stabilizer alone): 5 lbs. Weight on Support Plate with 9½ in. rods and cable-release handle: 7 lbs. 4 oz. Maximum accelerative force: 6g. Warmup time: 15 seconds. Diameter of entry and exit ports: 76mm.

Rear view of Image Stabilizer shows Support Plate with threaded camera mount. Custom brackets are available for various cameras. Stabilizer can be removed from camera in less than two minutes.

No light loss, no image degradation.

There are no lenses, liquids or prisms in the Stabilizer. Light rays pass through optical flats front and rear, and reflect off two front-surface mirrors. The light at the exit port measures the same as the light entering.

Doesn't perform miracles. *Does* work in a car, though.

The Stabilizer is for making shaky shots smoother, *not* for simulating a rock-steady tripod. Thanks to its low mass, you don't have to wrestle with unwieldy g forces inside the moving helicopter. That's useful in a *car*, too, of course. And you can get out of the car with the Stabilizer on your camera, and continue shooting hand-held. (It's quiet enough to shoot sync sound out of doors at typical telephoto distances.)

Proof of low mass space hardware sophistication: a gyroscope powered by one D cell flashlight battery.

To improve a gyroscope's effectiveness, you can increase either its mass or its RPM. For military purposes, British Aerospace had to make it small, light and efficient.

High speed with low mass requires exact dynamic balance, of course. Eccentricity and bearing friction would impair accuracy and soak up power. One measure of the phenomenal precision of this machine: The gyroscope – with its double gimbal and mirror – will run about four hours on a 1.5 volt D cell!

Low mass saves money.

A low mass device is likely to be compact. With this one, you can rent a 5 place helicopter at $300 an hour, and get steady shots *from inside*. No need to hang out of the open door, where the wind buffets the camera. And no need, either, for a 7 place helicopter at $400 an hour, or more.

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BEHIND THE SCENES OF STAR WARS THE EMPIRE STRIKES BACK

Picking up where STAR WARS left off, this rousing space adventure is even more technically intricate and dazzling than its predecessor

In the wake of the success of STAR WARS, George Lucas' desire to create a nine-part saga set in that distant galaxy far, far away became a viable aspiration and THE EMPIRE STRIKES BACK is a manifestation of that dream.

The new motion picture is a further episode in an epic adventure spanning forty years. The whole adventure is divided into three trilogies, with STAR WARS and THE EMPIRE STRIKES BACK as the first two parts of the middle trilogy.

"In choosing the episode to be filmed first," Lucas says, "I chose the chapter I felt the most secure with and which I liked the most." The result was STAR WARS: EPISODE IV—A NEW HOPE. The episode number and subtitle were dropped due to the length and the confusion they might have caused, but are being returned and will appear on new prints of STAR WARS.

Drawn from folk and fairy tales, myths, and a miasma of influences, STAR WARS provoked a variety of explanations for its exceptional appeal. "Perhaps hindsight will place it in perspective," said Irvin Kershner, while directing THE EMPIRE STRIKES BACK, "but this is certainly true—it appealed to the child in us all." Mark Hamill (Luke Skywalker, Lucas's alter ego) was as telling when he described it as "a celebration."

Whatever it was, for it is impossible to define an original, it brought pleasure to millions; it was an antidote to stress, suspending our belief in reality in favor of once-upon-a-time. Now, it seems, there is more, and for the background to the making of the new chapter, THE EMPIRE STRIKES BACK, we must go back in time.

The producer of STAR WARS was Gary Kurtz. A technician to his fingertips, a product of the University of Southern California Film School, his fortunes have been linked with Lucas's since AMERICAN GRAFFITI, which with Francis Ford Coppola, he co-produced. Lucas obtained 20th Century-Fox's backing, but the toughest time of all was when they needed money for the final special effects. "It was a touch-and-go situation as to whether the opticals would be completed," Lucas has since affirmed. "The buck stops at opticals." Later, with the experience of STAR WARS behind him, enriched by its success, Lucas would approach his new picture as an independent in every sense. THE EMPIRE STRIKES BACK would be a self-financed Lucasfilm production; its effects, miniatures, and opticals an in-house operation, the responsibility of another Lucas company, Industrial Light and Magic. Thus, Kurtz was able to proceed on the second film with an organizational structure behind him and the nucleus of the team that had served STAR WARS so well.

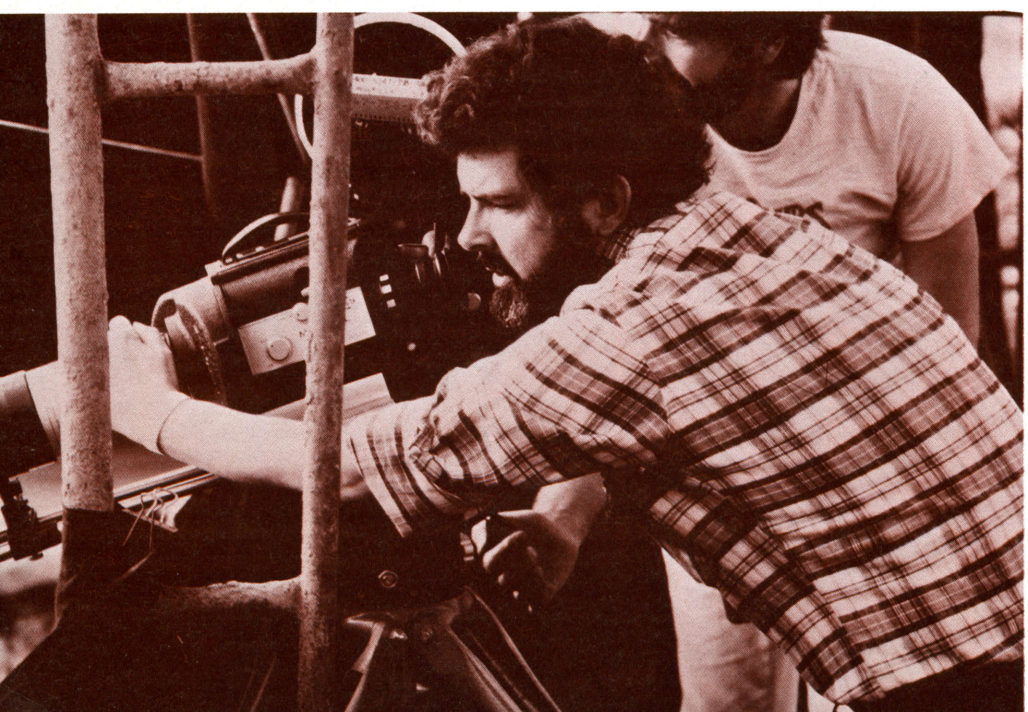
Lucas, himself, had no time to direct the continuation of his creation. Based near San Francisco, he continued with his writing and oversaw the special effects and the editing, while Gary Kurtz and director Irvin Kershner filmed it at the EMI Studios-Elstree, near London, where STAR WARS had been made.

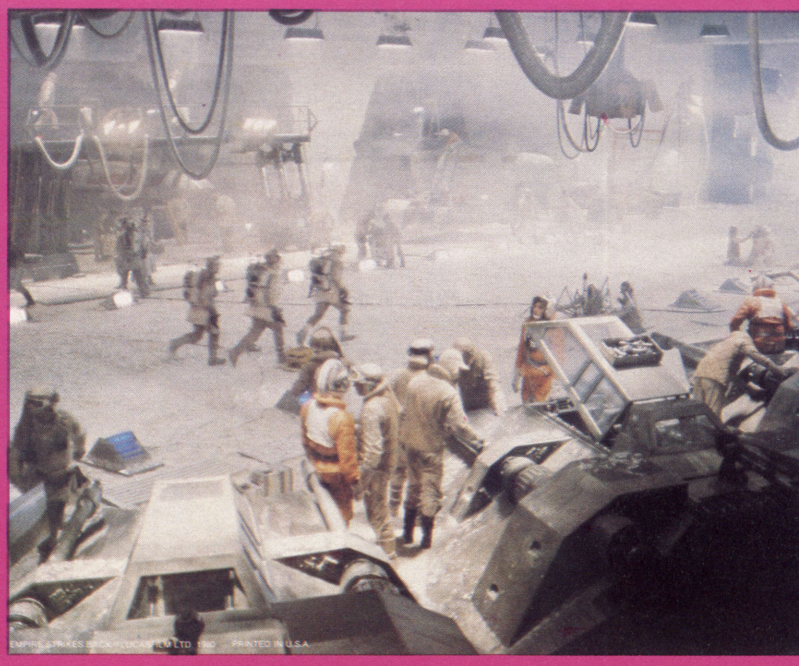
Kershner is a director whose films (EYES OF LAURA MARS, LOVING, A FINE MADNESS, THE FLIM-FLAM MAN, THE RETURN OF A MAN CALLED HORSE) Lucas thought underrated for their insights into human relationships. At first sight, Kershner seems a surprising choice for a space fantasy, particularly since he has had no experience with complex special effects, until one considers Gary Kurtz's statement in the fall of 1978: "In the new STAR WARS picture, the emphasis will again be on action and adventure, but having established the main characters, and having gained public acceptance for them, we intend to develop their emotional aspects, their relationships with one another." Also, even though Kershner has never made a science-fiction film, he is a fan of the *genre*: "I happen to love science fiction, and I've been reading it since I was a kid."

A rough draft of the screenplay for THE EMPIRE STRIKES BACK, based on George Lucas's story, was written by Leigh Brackett, the prolific and talented screenwriter and science-fiction novelist who died in March 1978, shortly after completing the draft. Following her death, Lawrence Kasdan was brought in to do the final draft. An impressive new writing talent, he has also written the

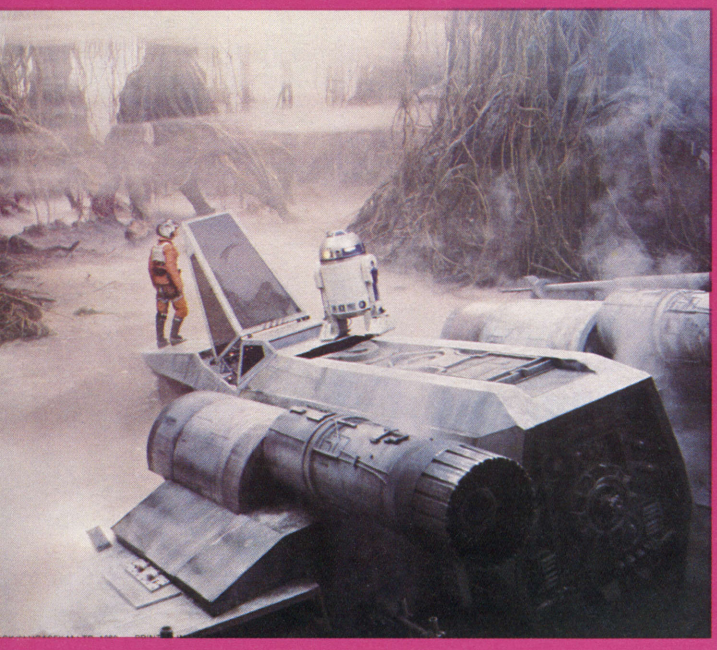
Continued on Page 600

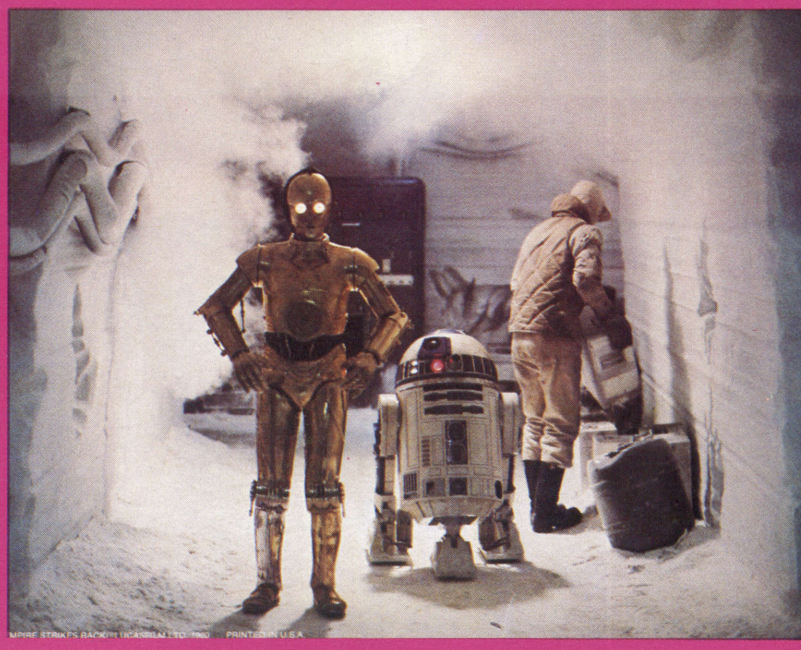
George Lucas, in whose fertile imagination STAR WARS was spawned, lines up a shot for its continuation, THE EMPIRE STRIKES BACK, for which he wrote the original story and served as Executive Producer. (Photo by Terry Chostner. All photographs pertaining to THE EMPIRE STRIKES BACK appearing in these pages © Lucasfilm Ltd. [LFL] 1980. All rights reserved.)

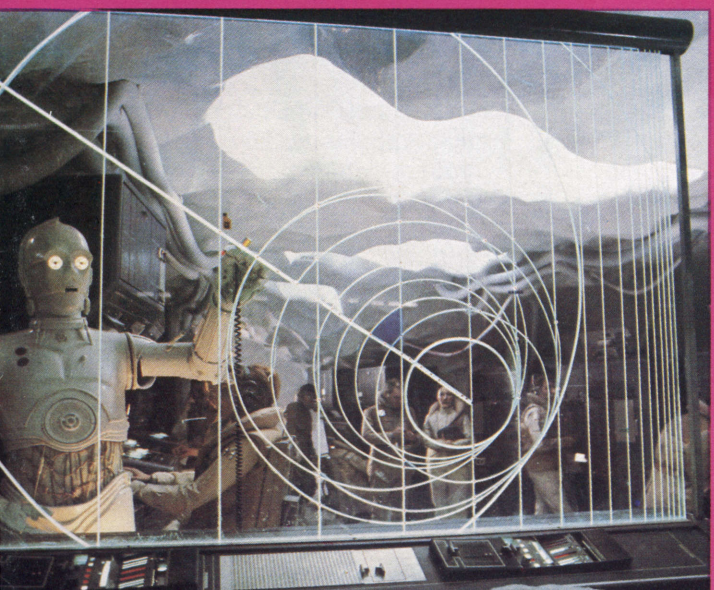




Scenes from THE EMPIRE STRIKES BACK, Produced by Gary Kurtz, directed by Irvin Kershner, Photographed by Peter Suschitzky, BSC, with George Lucas as Executive Producer, distributed by 20th Century-Fox. EMPIRE is a continuation of STAR WARS and picks up where that story left off, retaining the main characters, but adding several new ones. The live action was filmed at EMI Studios-Elstree near London, while the complex special effects were created at Industrial Light and Magic in San Rafael, California.







THE PHOTOGRAPHY OF STAR WARS THE EMPIRE STRIKES BACK

An Ice Planet, a Bog Planet and a Cloud City presented photographic challenges of a sort seldom encountered in our local galaxy

Peter Suschitzky, BSC, Director of Photography on THE EMPIRE STRIKES BACK, is the son of a famous cinematographer, Wolfgang Suschitzky, who came to England from Vienna, via Holland, in 1935 and who became closely connected with Paul Rotha of the British documentary film unit.

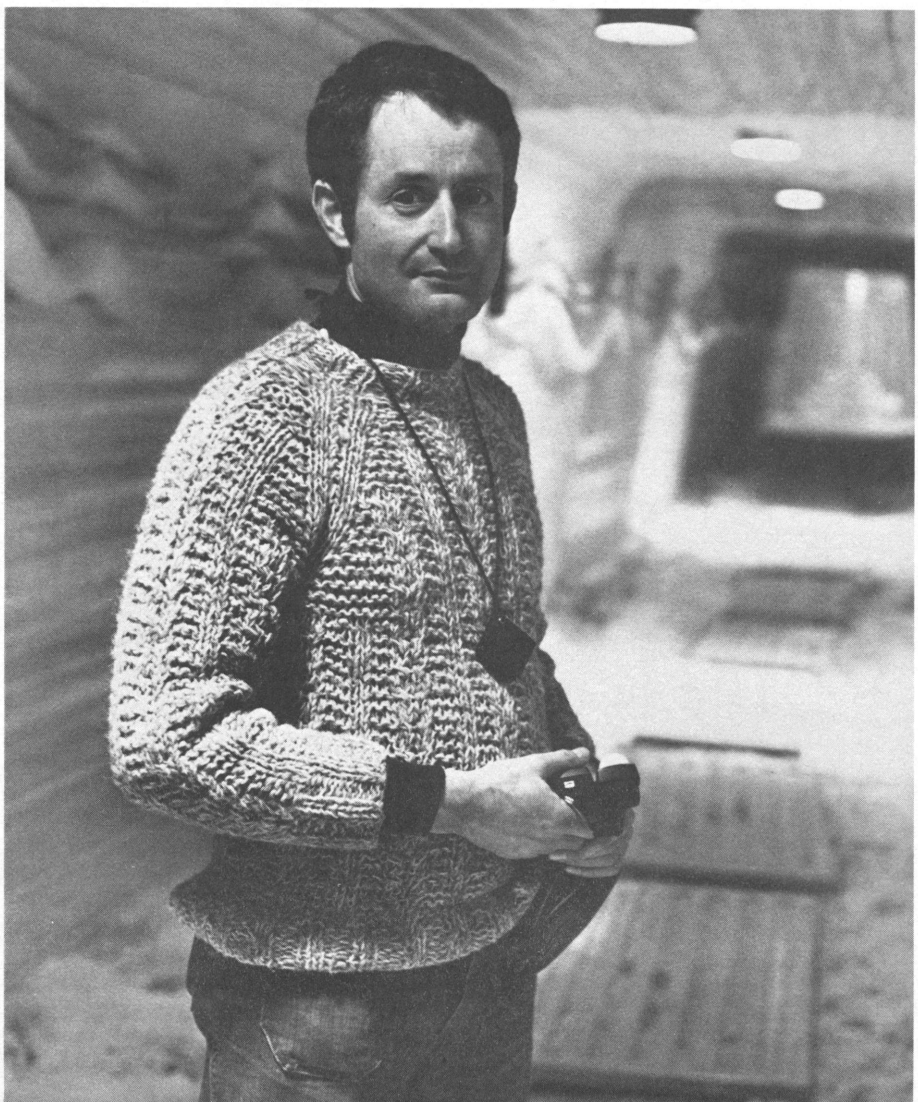
Born in Hampstead, London, Peter entered the British film industry in his late teens. Having been almost literally raised in the world of filmmaking, his progress was rapid and, by the age of 22, he was a fully recognized cinematographer.

His first film as Director of Photography was IT HAPPENED HERE, a clever evocation of what Britain might have experienced if Hitler had won the war. In the 1960's he photographed PRIVILEGE and CHARLEY BUBBLES. It was in association with director Ken Russell that he graduated to movies of international stature, photographing VALENTINO and LISZTOMANIA. His feature credits also include ALL CREATURES GREAT AND SMALL.

Like many top cinematographers working today, Suschitzky also photographs commercials between feature assignments. These have taken him to many countries (including the United States and Australia) and have won him several awards, including a Best Commercial award at Cannes. THE EMPIRE STRIKES BACK is the first space fantasy he has photographed.

Upon the completion of his work on EMPIRE, he was interviewed in London by David Samuelson as follows:

The son of a famed cinematographer, Peter Suschitzky, BSC, Director of Photography on THE EMPIRE STRIKES BACK, entered the British film industry in his teens and had become a full-fledged cameraman by the age of 22. Photographing two Ken Russell pictures (LISZTOMANIA, VALENTINO) prepared him for the wild goings-on he encountered in EMPIRE.



DAVID SAMUELSON: It is my impression that you were "born" more into photography than into the film industry, per se; isn't that the case?

PETER SUSCHITZKY: Whilst I was a child I had learned a lot about photography and my father certainly helped me, teaching me all the processes of printing and developing. I remember starting out with gold-toning daylight printing in those days. My first camera was a Kodak box camera, but I developed lots of other interests when I was growing up and it certainly wasn't a foregone conclusion that I should go into films straight from school. However, I took various exams at the end of school and was almost on the brink of pursuing something to do with music when it occurred to me that I should really follow what I knew I could do rather well– namely, photography.

QUESTION: From that general interest in photography, how did you focus your emphasis toward cinematography?

SUSCHITZKY: I had always been interested in film work, but I thought I would go to film school in order to find out if that was the direction I really wanted to follow. I went to a film school in Paris called IDHEC. When I finished there, I got a job as a clapper-loader boy

in a small studio in London. Very soon after that I managed to move on from that studio (which was only making commercials) to another part of the same company that was producing documentaries for TV. I spent six months there and at the end of that time I was asked by the head of the company if I would like to go to South America to be a cameraman on a series of documentaries. So there I was, after only maybe a year and a quarter in the industry–I was 20 or 21, I think–being asked to go and be a cameraman.

QUESTION: And how did it work out?

SUSCHITZKY: It was a one-man-band operation–just myself and a journalist–and I spent a year in South America, hardly ever seeing rushes. I think I picked up an awful lot of experience in what it means to be in films, because I had to do sound recording, see my equipment through customs and book hotels, as well as do the lighting and the operating, the loading and everything that a one-man-band does. When I got back to England I was fortunate enough not to be obliged to work because I had saved up some money. At that time I had a call from an ex-colleague of mine who was making a film on weekends in 35mm, and he asked me to photograph it. It turned out to be a film called IT HAPPENED HERE, directed by Kevin Brownlow. It was my first feature film and it subsequently had quite a wide public distribution. I think I was 22 at the time and it really was plunging in at the deep end, as my previous experience had not quite prepared me for a feature movie. But the results seemed to be alright, and I just learned by my mistakes.

QUESTION: What was your next step?

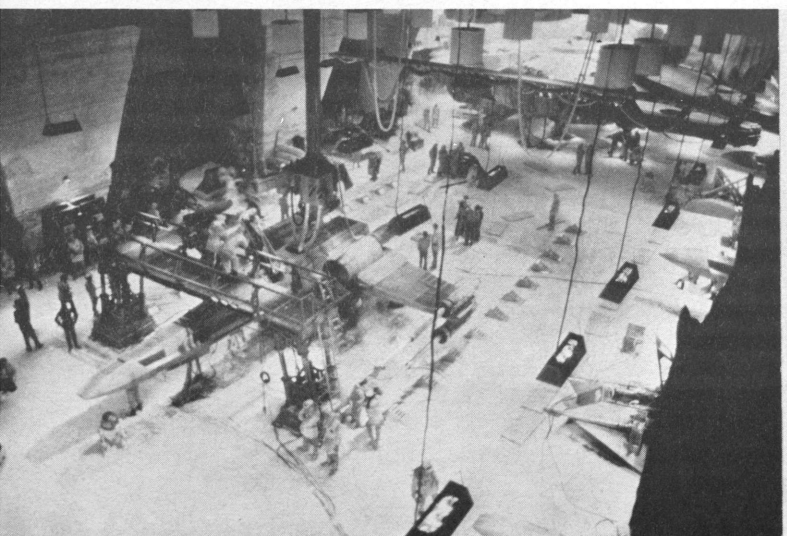
SUSCHITZKY: Well, I now had something to show–which is always the first stumbling block for any cameraman, director or actor–and that helped me eventually to obtain the assignment for my first professional feature two or three years later. I then photographed two features for Universal. One was Albert Finney's CHARLIE BUBBLES and the other was a film with Peter Watkins called PRIVILEGE. That was a good period in British films, the mid-Sixties, when there was a lot of activity over here. I was really very fortunate and took advantage of my luck. Since then I have not, perhaps, photographed as many feature films as I could have, because I have never liked going straight from one film to another. Even so, I suppose I must have been involved in 20 features as a Lighting Cameraman. Going backwards, the most recent pictures have been THE EMPIRE STRIKES BACK, VALENTINO and LISZTOMANIA (with Ken Russell), another two films with Peter Watkin, three or four with Warris Hussein (including a film with Sandy Dennis called THE MILLSTONE), a film with John Boorman called LEO THE LAST (starring Marcello Mastroianni), two films with Claude Whetham (one of which is often called THAT WILL BE THE DAY), and a film with Peter Hall, MIDSUMMER NIGHT'S DREAM. I am probably leaving out quite a few as I go through, but those are the principal ones. Now I am nearly 40.

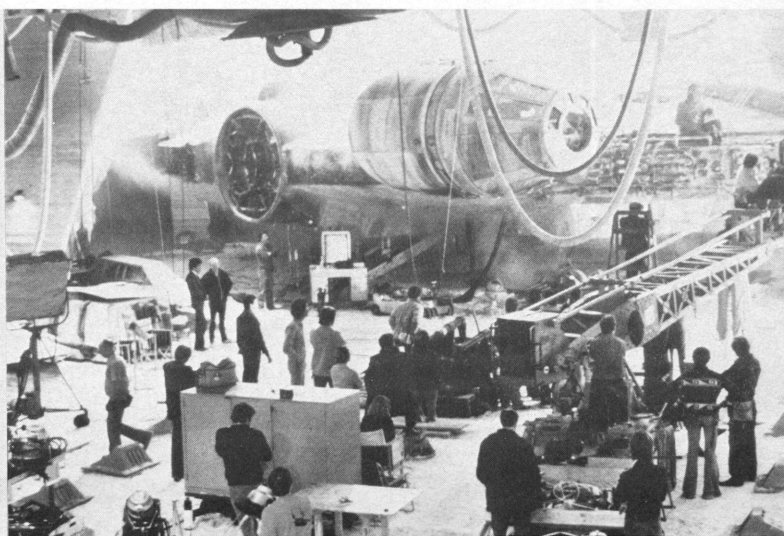
QUESTION: How did you get involved with THE EMPIRE STRIKES BACK in the first place?

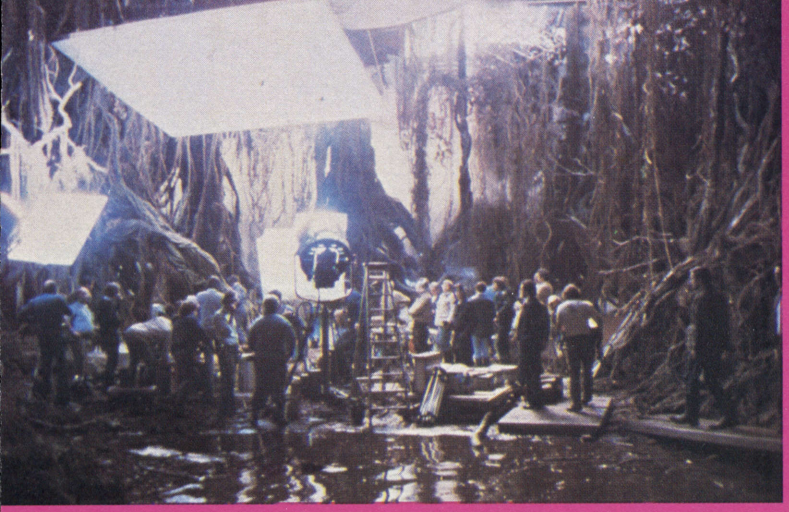
SUSCHITZKY: I was approached about photographing the original STAR WARS, so my contacts with George Lucas and Gary Kurtz date back a few years now. In any event, as I suppose everybody

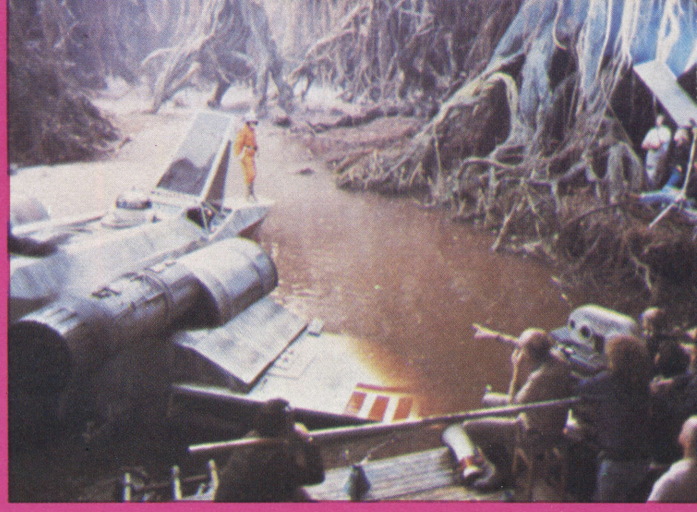
Rebel soldiers preparing to fire the dish laser gun on the Ice Planet Hoth. This arctic battle, filmed on the Hardangerjokulen Glacier in Norway, with intercut stop-motion animation by ILM technicains, is one of the most stunning sequences of its kind ever put on film.

Huge sets, such as these showing the interior of the gigantic Rebel hideout in an ice cavern, were built to fill all eight stages at EMI Studios-Elstree, plus a spacious extra stage built especially for filming EMPIRE. A holdup in production was caused by the fact that Stage 3 at Elstree, previously in use by Stanley Kubrick for THE SHINING, burned to the ground. This forced Kubrick onto another stages, thus denying EMPIRE two stages the producers had counted on for their March, 1979 start of production. (Photos: Gary Kurtz, left and Douglas Dawson, right.)

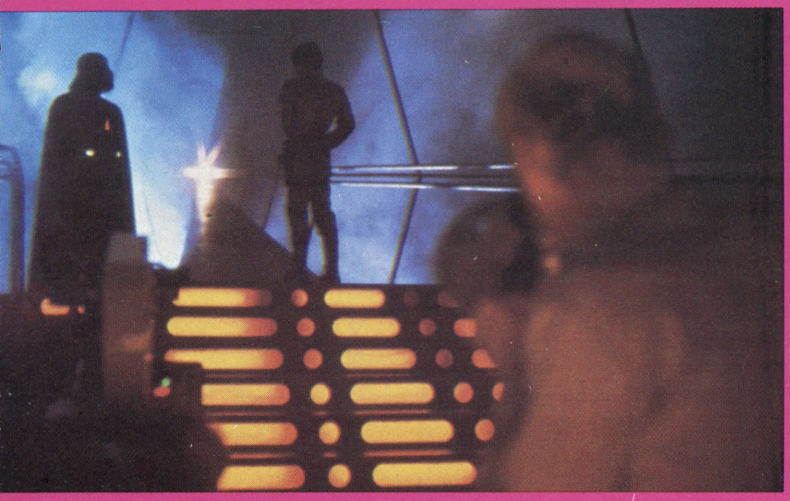


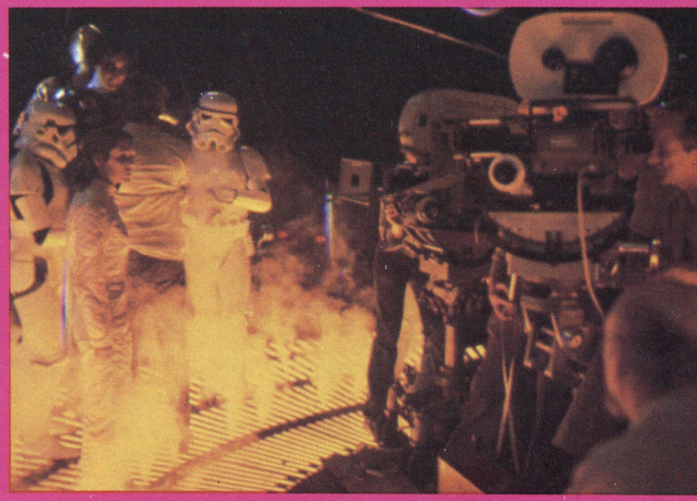






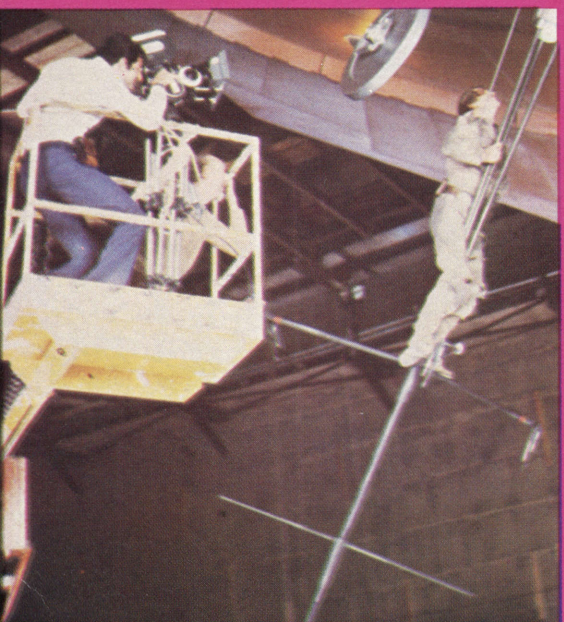
(LEFT) Preparing to shoot a scene on the Bog Planet. (Photo: Nancy Moran.) (RIGHT) Another view inside the flooded new stage at Elstree, showing a different perspective of the Bog Planet. (Photo: Gary Kurtz.) This huge "STAR WARS" stage, built especially for EMPIRE filming, is 250 feet long by 122 feet wide by 45 feet high. The biggest of the interior sets, nevertheless, required a 30-foot extension. (BELOW LEFT) The final Cloud City sequence made use of colored light. (Photo: Gary Kurtz.) (RIGHT) Camera set-up to shoot a scene of Princess Leia and the Storm Troopers. (Photo: Nancy Moran.)





knows, I didn't do the film; Gil Taylor did it. But then they approached me again about photographing THE EMPIRE STRIKES BACK. This happened a good year-and-a-half before production began, which was certainly the longest term of involvement I have ever experienced. I was always impressed with the extent to which they planned and the way they thought everything out so very thoroughly. Over the course of that year-and-a-half, I had several meetings with them, either here or in Los Angeles. If I found myself over there, I would go up to San Francisco and visit their studio and talk with the people who were going to be doing the model work. I'd ask their advice and give them my opinions and feelings about what I would be doing, and we had a fairly useful exchange, I would say.

Director of Photography Suschitzky lines up camera for a shot of Luke Skywalker as he clings to a cable in climactic sequence of EMPIRE.



QUESTION: How special is working with special effects?

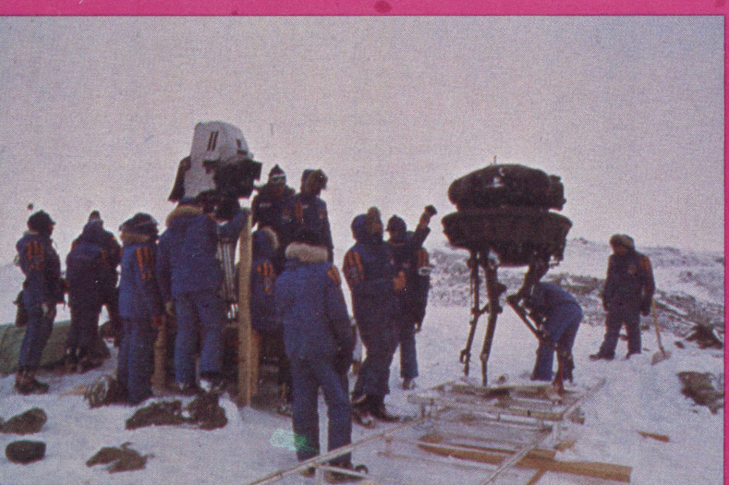
SUSCHITZKY: Well, before you actually experience it, the term can be slightly intimidating. Over the years, when I have heard terms which to me denoted something I had never done myself, it was sometimes just a reference to a field which I knew little about. But, in fact, there is no mystery to it. It is just one of those processes which one can understand—and certainly in lay terms—understand fairly rapidly. Having done it all now, I must say that I am not intimidated by any of the terms anymore. We had a lot of matte work to be done on VistaVision, and I had never seen a VistaVision camera in my life. And before I had seen it, I certainly didn't know what it was going to be like to work with. I can't say that I am in love with it, but the results, after a lot of toil and tears, were worth the effort one put into it. Taking that camera to Norway—into the extreme

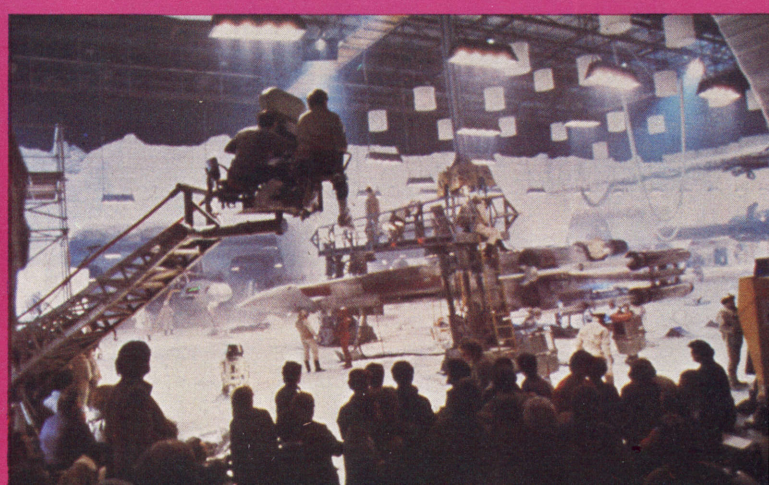
Continued on Page 576

A Full-size mechanized Tauntaun, a proud mythical beast of the Ice Planet Hoth, is readied for a run across the frozen wastes of Norway.

The set for the Cloud City laser sword duel between Luke Skywalker and Darth Vader gave Peter Suschitzky some early qualms. Having no walls, it appeared unfinished, like a stage setting. Also, the interesting elements were on the floor or the ceiling, with not much showing from an eye-level angle. He made it work by lighting the whole thing from underneath through translucent floors and by placing Brutes to send shafts of light through the darkness. The result: dramatic and believable.

(LEFT) Setting up to shoot on Norwegian glacier location. (Photo: Gary Kurtz.) (RIGHT) The crew assembled outside quarters (a former cross-country ski lodge) at Finse, Norway. (Photo: George Whitear.) The winter of 1978/79 proved to be one of the worst in living memory, the company being plagued by avalanches and "white-outs". (BELOW LEFT) Filming a "Probot", a remotely controlled robot probe sent by the Empire to locate signs of the Rebels holed up on the Ice Planet. (Photo: Knut Vadreta.) (RIGHT) A crane shot inside the huge ice cavern set. (Photo: George Whitear.)





SPECIAL VISUAL EFFECTS FOR STAR WARS THE EMPIRE STRIKES BACK

The visionary zeal—the nuts and bolts—the blood, sweat and tears involved in creating this dazzling display of cinematic legerdemain

By RICHARD EDLUND
Special Visual Effects Co-supervisor

The most important consideration in setting up Industrial Light and Magic, the facility that produced the special effects for THE EMPIRE STRIKES BACK, was finding a staff.

We have an organization that is really dependent upon the interreaction of departments on a fairly immediate basis and our building is small, as compared to normal studios in the motion picture industry at large. It's somewhat of a disadvantage to have a space that is not quite big enough, but, on the other hand, it is an advantage in that it forces you to compact the departments closely together and to utilize this little nook and that little nook. The positive result is that all of us work close to each other and pass each other frequently in the course of doing our work, which is very complex in nature. The coffee machine is our most important meeting place, and when we pass each other in the hallway we can say, "What about the density in this scene?" This kind of thing happens in the normal course of getting from one place to another in the building, so we don't have the problem of departmentalization.

If the matte department were a block away from the optical department and the shooting stage were somewhere in the distance, we would lose that contact. If you are a block away, you may as well be miles away, because the work we do is so intricate and detailed and you get so involved in your aspect of it that unless you automatically tend to bump into each other you don't communicate.

One of our major problems in the beginning was to cope with the logistics of the various departments and decide how they were to be set up. This was difficult to do at first and we tried to look as far ahead as possible, because once you put an optical printer down and set up a department around it, that set-up gets fairly firmly entrenched. Things get bolted to floor, utilities get piped in, air conditioning systems get installed. All of this is going to be there for quite a while, so you have to be careful about where you put things. This, together with the initial challenge of coming up into an environment (San Rafael) that was not oriented toward film, probably presented one of our chief difficulties in getting started.

Getting back to the problem of finding a staff—since we knew that there was no film labor pool, *per se,* in the San Francisco area (and certainly not that many people who had specific experience along the lines of the oddball type of work we were doing), it became obvious that we would have to draw most of our skeleton crew from Los Angeles. With that in mind, we tried to find the best people we could who would be willing to uproot their lives and move away from the hub of the film industry.

Bruce Nicholson (Optical Photography Supervisor), Dennis Muren (Effects Director of Photography) and I were approached at about the same time. Dennis and I were to share the work as effects cameramen, but I have been functioning more as a supervisor than a cameraman and have been enjoying that position. Lorne Peterson (Chief Model Maker) was a veteran of STAR WARS. Conrad Buff (Visual Effects Editorial Supervisor) didn't work on STAR WARS, but he had worked on an intermediate project with us, did excellent work and was definitely the person we wanted on THE EMPIRE STRIKES BACK. These were among the key personnel in the production departments.

In the support departments, such as machine shop and electronics systems

Special Visual Effects Co-supervisor Richard Edlund was given the staggering task of starting a highly sophisticated special effects unit from scratch in Marin County, far from his Hollywood base. The resultant facility, Industrial Light and Magic, more than met the complex challenges presented by THE EMPIRE STRIKES BACK.

development, there was Gene Whiteman, who became Machine Shop Supervisor and was a real lucky find. I didn't know him before we started, but he became a very good friend and was extremely adaptable to all of the many and varied projects that we wound up getting into. On a production like this every day brings something completely different. We don't know what's happening until we walk in and all of a sudden find ourselves faced with a problem and have to work our way out of it somehow. That's just the nature of the work.

Jerry Jeffress, who is from the Bay area, became our Electronics Supervisor, and Kris Brown our Systems Engineer. The Stop Motion Animators, Jon Berg and Phil Tippett, had done some work on STAR WARS and were a very, very important part of this picture.

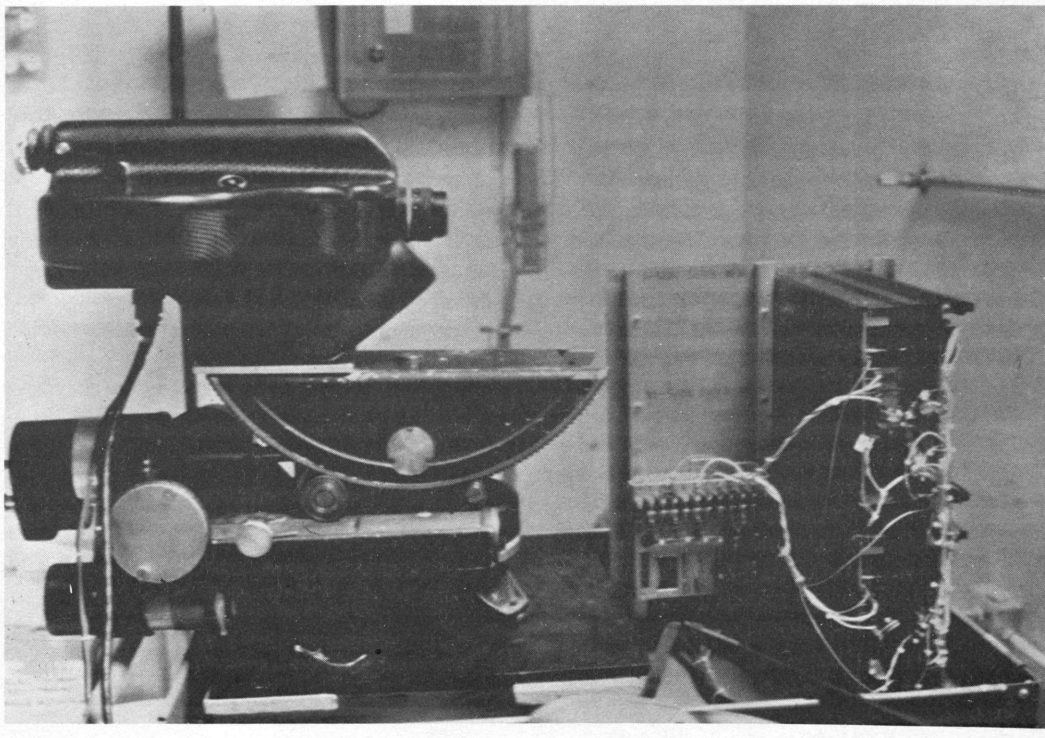
On STAR WARS we had only two basic motion control cameras, both of which worked very well almost from the outset. On EMPIRE we had those two cameras, one other camera which I rented from Lin Dunn for a while, and one high-speed camera which I rented from Paramount and which was capable of somewhere between 96 and 100 frames per second. Those were the cameras we had to work with—except for some shots that were done in anamorphic and which we filmed with standard cameras. Our work seemed generally to involve either a half-second to 30 seconds of exposure per frame or 100 frames per second or some other multiple of normal speed. Not much material was shot at sound speed, because we were always taking advantage of some quirk in the persistence of vision to effect our trick photography in one manner or another.

One of the projects which I initially started on was the building of a new high-speed movement in the VistaVision format by the Mitchell Camera Corporation. Only two of these had been made in the Fifties, when the company was in full production with an enormous assembly line. Now they had to drag the blueprints out of their files and I knew it would take them several months to complete the two movements that I ordered.

Meanwhile, we began design on a *reflex* VistaVision camera, which didn't exist at that time. We had a movement which we could use for that one and we immediately began building the housing, which we wanted to get finished in time for it to be delivered to the location in Norway. It had to have built-in heaters and be able to work at 30 degrees below zero. That was a real challenge and we came through on it. The reflex camera took three months to build and it worked fine. We finished it just sort of in the nick

Continued on Page 564

Jerry Jeffress, Electronics Systems Designer, inspecting inner workings of the high-speed "Empire" (modified VistaVision) camera, designed and mainly built at ILM. (Photo: Nancy Moran.) (BELOW) Empire camera set up on motion-control head back at ILM, after having seen service on the Härdangerjokulen Glacier in Norway. (Photo: Miki Herman.)



"O PIONEERS!" OR "INSIDE I.L.M."

A deceptively quiet installation in San Rafael, California is the magic factory that spawned all manner of on-screen wizardry for "EMPIRE"

By ALAN ARNOLD

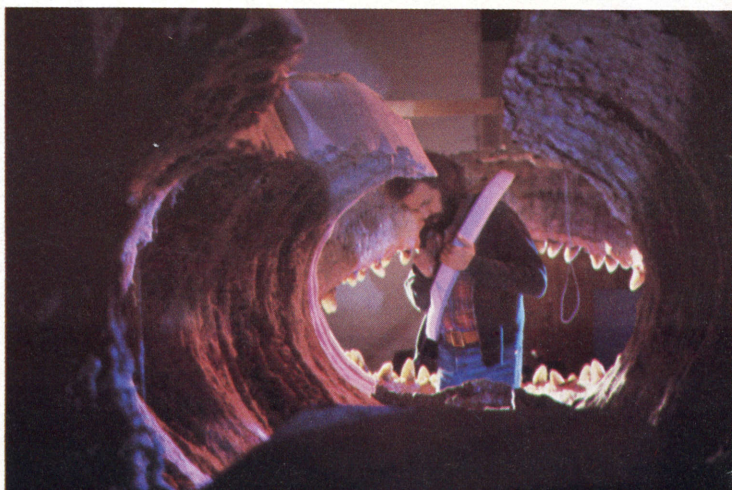
The factory-style building on a trading estate at San Rafael, California, which houses Industrial Light and Magic, and where some seventy people are employed, gives no outward hint of a connection with show business. Yet it is a film studio in miniature where about one-fifth of THE EMPIRE STRIKES BACK has been filmed—without actors. When you enter the reception area the only feature to suggest that the product of the company is unusual is a colored plaque showing a figure in top hat and tails waving a wand, unmistakably a magician. It is the trademark of this house of magic.

Behind this area and some offices are workshops and laboratories where technicians, whose average age must be under thirty, work with that air of abstraction characteristic of the scientific mind. They seem unhurried, absorbed in detail; they confer with one another fraternally. At the end of the day they are replaced by a nightshift. Around the clock scenes for the space fantasy were being filmed which have no earthly counterpart. You could not shoot them "live"; they don't exist. No location could provide their sometimes awesome scope. Where could you go to shoot the destruction of a star or film machines like monstrous animals trudging across an infinity of snow? Only here is that possible for this is where the barely imaginable is brought to life, and it is done by stretching technology to its furthest reach.

From a tour of the departments and talking to the supervisors I gathered that a locked print of the picture had been delivered to them and that they had started processing into it the effects they have been developing over the past year, and they are still creating more. Work was proceeding on the miniatures and opticals and on the stop-motion and animation for scenes with animal and mechanical creatures. An exceptionally complex sequence showing the Millennium Falcon flying through an asteroid belt pursued by Imperial Tie-fighters was being meticulously crafted and I saw some clips from it when George Lucas joined his team in the viewing room. Although it seemed to me an incredible achievement, the technicians were not satisfied. The spaceship was not maneuvering to their complete satisfaction so they talked the problem over using terminology I could not synthesize into the language of every day, and at the end

(LEFT) Immediately following the explosion of a Speeder against a blue screen at Industrial Light and Magic, the crew rushes in to extinguish any fires that may be burning. Dozens of explosions of various scales were rigged and photographed at ILM for "EMPIRE". (RIGHT) Cameraman Ken Ralston sets up what's left of an exploded TIE fighter against the blue screen. (Photos: Howard Stein.)

(LEFT) Ted Moehnke, Supervising Stage Technician, working on his own invention: an asteroid machine with hundreds of gears that rotate asteroids at varying speeds with repeatable moves. (Photo: Howard Stein.) (RIGHT) Lorne Peterson, Model Shop Supervisor, working on set representing the mouth of a giant slug which swallows the Millennium Falcon spaceship.



of the discussion like all good boffins they returned to their benches and drawing-boards.

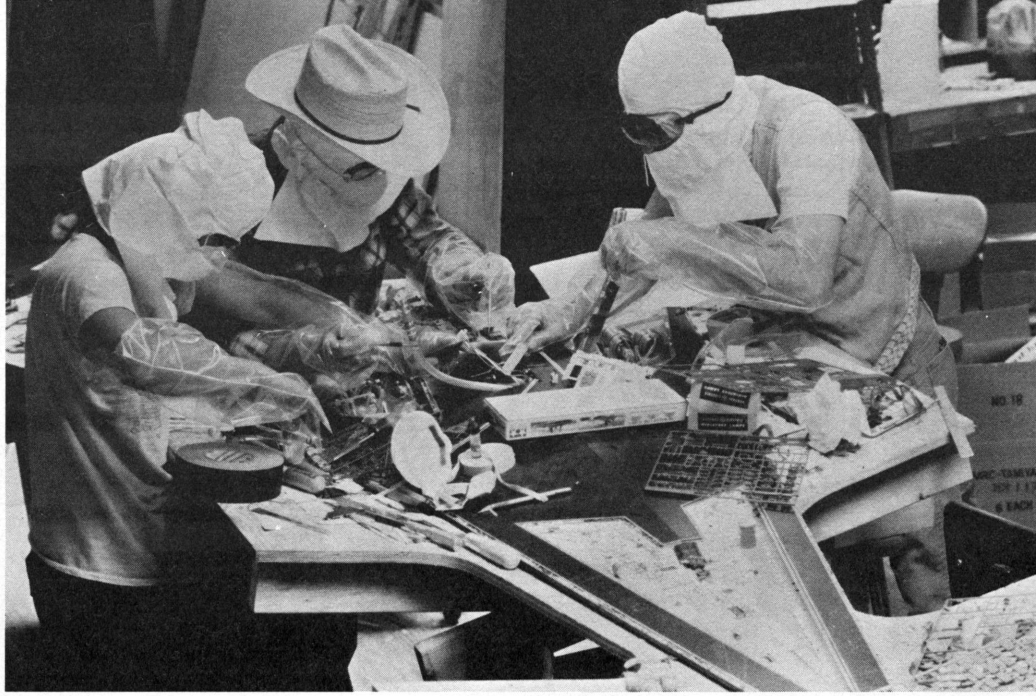
Another problem occupying them was the devising of a special matting required for scenes showing the Rebel Snowspeeders maneuvering against a snow background, match-ups with the Norwegian footage of the battle on Hoth. The Snowspeeders are a light grey and near-white against white is a difficult effect to achieve so that much pioneer research would be needed to resolve the problem.

This was filmmaking of a kind I had never seen before. I am sure that if I had visited the Disney studios at the height of the cartoon feature's popularity I would have been similarly thrilled and I would have understood their expertise. But this was spaceage technology employing pure science and no less impressive for being beyond my grasp. Computerized cameras, rotoscoping, laser animation, garbage mattes, animatics were merely terms to me but this, I knew, was the special effects technology that made STAR WARS a spellbinder and thrust technical effects forward to a point far beyond that reached by any predecessor. By now they had four more years of development behind them. I came away bedazzled.

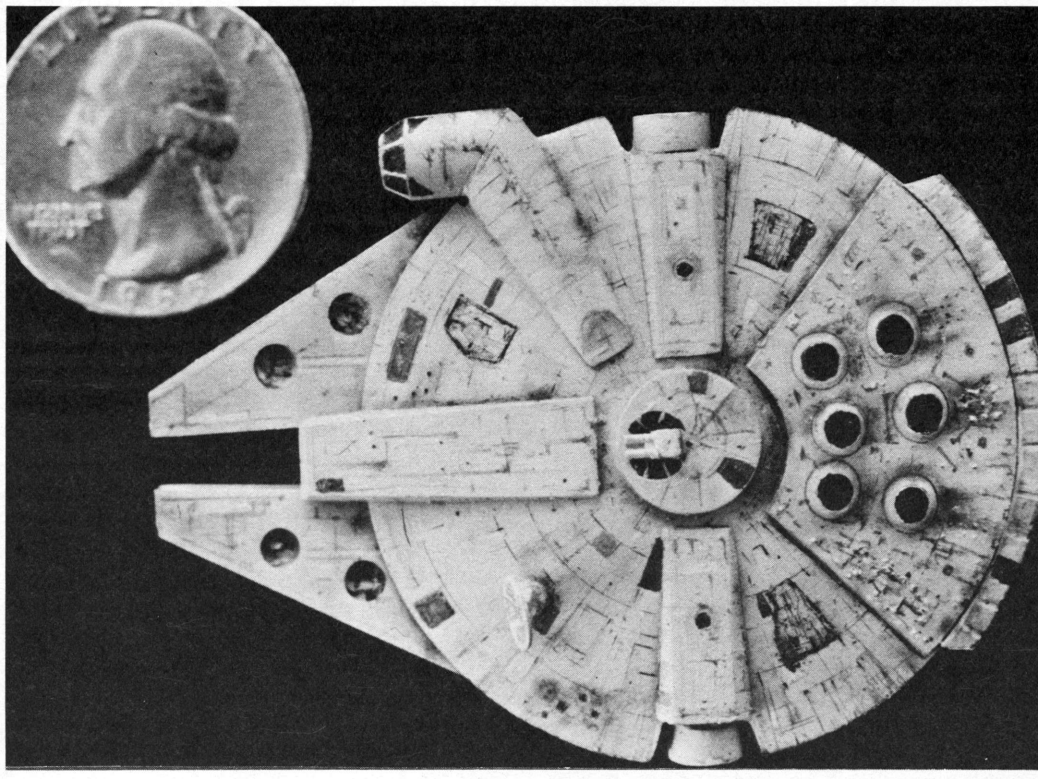
On returning to my room I picked up D.J. Wenden's book, *"The Birth of Movies"* and read an account of how another filmmaker approached the matter of making space movies. "George Melies," the account began, "combined the skills of magicians with those of trick cameramen to produce fantasy and adventure films which told intricate stories in a style which only the cinema could produce. People disappeared mysteriously, strange ghost-like apparitions emerged, animals changed into human beings and flew through the air. He developed the technical tricks of the cinema . . . His most famous film, A TRIP TO THE MOON, was half-way between the science-fiction of Jules Verne and the televised lunar exploration of Neil Armstrong. He showed the astronauts planning the trip, constructing a projectile, being shot off to the moon, landing in the eye of the man in the moon (who wept a large tear), descending into a lunar crater, being attacked by the inhabitants, fleeing and splashing down in the sea and sinking to the bottom. The film ended with their ultimate retrieval and a triumphant processional parade."

But, you see, George Melies made his film in 1902. O pioneers! ■

(An excerpt from Once Upon A Galaxy, *a journal on the making of THE EMPIRE STRIKES BACK.)*



Looking uncannily like surgeons in an operating theater, three anonymous technicians perform open heart surgery on Darth Vader's Stardestroyer. (BELOW) The smallest scale miniature of the Millennium Falcon spaceship, shown next to a quarter coin for size relationship. Several scales of miniatures were constructed. (Photo: Howard Stein.)



Left to right: Doug Beswick, Jon Berg and Phil Tippett animating the Snow Walkers. Face masks were used to prevent the technicians from inhaling baking soda used to simulate snow. Technicians devoted many long hours to filming the tedious, but spectacular stop-motion animation scenes. (Photo: Terry Chostner.)

For Entries in the First Annual World Wildlife Conference and Film Festival!!

Dear Filmmaker:

The World Wildlife Foundation, a nonprofit, tax-exempt organization raising funds for a multi-million dollar wildlife museum in Tucson, Arizona, cordially invites you to submit your finest wildlife film entries for consideration in a competition to determine the best wildlife film productions. Prospective competitors are required to submit entries, together with a $50.00 entry fee for each film.

All entries in both professional and amateur categories will be viewed and judged by the public on photographic quality, informational/educational content and artistic quality . . . Final judging of the top 10 films will be determined by the Technical Film Review Board . . .

Winner of the best Professional wildlife film will receive a check from the World Wildlife Foundation for $5,000! . . . Second Prize for the best professional wildlife film is $3,000! . . . Third Prize - $2,000!

Winner of the best Amateur wildlife film will receive a check from the World Wildlife Foundation for $1,000! . . . Second Prize - $750.00! . . . Third Prize - $500.00 . . . PLUS . . . Gold, Silver and Bronze awards in special categories.

All producers are invited to attend a spectacular special Awards Presentation Dinner at the MGM GRAND HOTEL, Reno, Nevada, July 26, 1980.

TO ENTER YOUR FILMS IN THE COMPETITION: Fill out the attached entry form completely, attaching one form and the film's entry fee to each film you send and mail to:

WORLD WILDLIFE FOUNDATION, 5151 E. Broadway - Suite 1680, Tucson, AZ 85711

Film Title: _____

Category: Professional ( ) Amateur ( ) Entry Fee Enclosed ( ) ($50.00)

Producer: _____

Cinematographer: _____

Director: _____

Return Film to: _____

_____

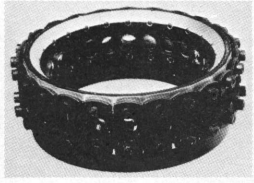
_____

A representative will be attending the awards presentation ( )

All entry fees shall be considered donations to the World Wildlife Museum; 5151 E. Broadway — Suite 1680, Tucson, AZ 85711. For further information, contact: Elizabeth Osborne, (602) 745-0126.

Deadline for entries is June 20, 1980.

We have a head for pictures...



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THROUGH THE GALAXY FROM ICE PLANET TO BOG PLANET

A liaison between units working separately in London and California, melding their talents to create a film that will excite the audience

Before Brian Johnson, Co-supervisor of Special Visual Effects, began working on THE EMPIRE STRIKES BACK, he had been working on ALIEN, and had designed and directed the special effects for forty-eight episodes of the television series, SPACE 1999.

Born in London, he became a camera assistant in the British film studios before joining the Royal Air Force for two years, during which he worked on instrument landing systems. On returning to civilian life, he became interested in that branch of filmmaking which has increasingly combined computer technology and photography.

He gained his experience with such notables as Les Bowie and Douglas Trumbull, and on such films as THE DAY THE EARTH CAUGHT FIRE; the horror pictures, WHEN DINOSAURS RULED THE EARTH and PHANTOM OF THE OPERA; and on 2001: A SPACE ODYSSEY, having worked on the latter for over two years. In recent years his credits have included McKENNA'S GOLD, MOSQUITO SQUADRON, THE TAMARIND SEED, THE MEDUSA TOUCH and THE REVENGE OF THE PINK PANTHER.

He was part of the team that recently won "Best Achievement in Visual Effects" Academy Awards for their work on ALIEN.

In the following interview for *American Cinematographer,* conducted at Industrial Light and Magic, Inc. in San Rafael, California, during the final stages of production, he discusses his work on THE EMPIRE STRIKES BACK:

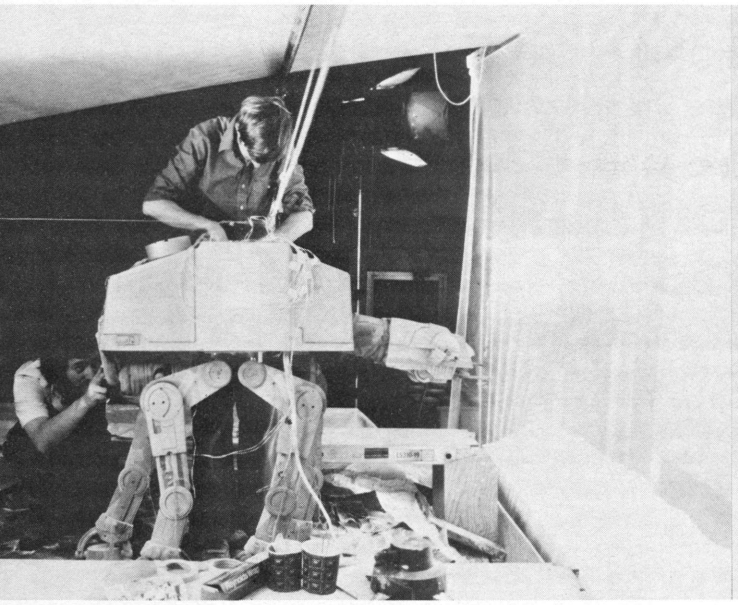
Like a modern-day Merlin rising from the mists, Brian Johnson, Co-supervisor of Special Effects on THE EMPIRE STRIKES BACK, supervises the shooting of an effect on the Bog Planet involving a lot of dry ice. Johnson, who recently won an Academy Award for his work on ALIEN, was involved in the film throughout its production. (Photo: Terry Chostner.)

QUESTION: Since production on THE EMPIRE STRIKES BACK is moving into its final phases, can you give me your impressions of the project?

JOHNSON: Basically, EMPIRE is a continuation of STAR WARS, but with a lot of new "wrinkles", many of which, by the process of elimination, have evolved as the picture has gone on. It's obviously been a great challenge for everyone involved. I think George Lucas was determined that we weren't just going to make a picture that would be better than the previous one. However, with all the sequels to movies coming out, just to get a good sequel is a challenge in itself. Bigger and better doesn't necessarily apply. I think that in EMPIRE there are certainly a lot of things that are definitely better than before. Certain sort of mythical characters appear in this one that also appeared in STAR WARS. It's a fairy tale again, but it's not an attempt to climb on the back of STAR WARS and just have another fizz-bang thing. It's a totally new story. So, in many ways, it's been a different sort of challenge. Subtler things take place in this one than in the first one.

QUESTION: Can you describe some of the specifics of how you've been involved with the EMPIRE STRIKES BACK?

JOHNSON: Well, the whole movie. I've been involved in the entire project. The people here at ILM are very professional, so, in terms of my involvement in this phase, it has been a question of throwing in a suggestion here and guidance there and basically evaluating what



(LEFT) Large (four-foot) Snow Walker being rigged with explosives by Joe Viskocil (left) and Dave Pier (right), Pyrotechnics Technicians. (Photo: Howard Stein.) (RIGHT) Jon Berg, Stop-motion Animator, using trapdoor in center of snow set to animate Snow Walker. (Photo: Terry Chostner.) The battle on the Ice Planet is a *tour de force* of state-of-the-art motion picture technology—quite possibly the most intricate special effects sequence ever filmed, and certainly among the most spectacular. Johnson lauds the crew as having done "an absolutely amazing job" on it.

George wants, interpreting it and passing it on to the various people concerned. I've also had a hand in devising specific effects. For example, at the moment I'm involved in designing a rig for R2-D2, who has to be spat out on the surface of the bog planet by a monster. That has to be done to solve various problems that occurred in England. The newly built STAR WARS stage at EMI Studios was originally designed to be flooded to quite a depth, but because of problems in construction and the time factor, it turned out that it could only be flooded to a depth of three or four feet—which meant that we couldn't get the R2-D2 rig into the water. It was pulled out of the water and it wasn't really satisfactory, so I've redesigned the whole thing over here and am approaching it from a different angle.

QUESTION: To what extent has this picture been storyboarded?

JOHNSON: We storyboard every single shot in the movie, but we update the storyboards as we go along, because, obviously, until George has the material in his hand, it is very difficult to evaluate exactly how the shots are going to go. We sort of broke the back of most of the elements earlier on, but then there's the process of retuning certain elements and reshooting various bits which, once you see the thing cut together, didn't quite work out the way you'd storyboarded them. In fact, along the way we've discovered better ways of doing some of the things. We've reevaluated them and, as a result, have wound up with about 90 extra shots—which always happens on this sort of movie. So we've been very busy getting all of these elements shot and composited before the cut-off date.

QUESTION: Would you say that the technical problems on EMPIRE are more complex than they were on STAR WARS?

JOHNSON: We've had some new problems. We've got extensive stop-motion animation sequences in this one, whereas stop-motion was used only for the chess game sequence in STAR WARS. In this show the Walkers and the Tauntauns are animated and it's one of the problems of animation that you have, in effect, a series of still pictures projected at 24 frames per second, so that you get this sort of "stepping" effect, which the brain automatically senses as not being for real. Even an amateur would know that something is wrong, although he wouldn't be quite sure what. It's the essentially static quality of the puppets in each frame that gives the game away. I'm very pleased to say that we've overcome that problem.

QUESTION: What about problems relating to equipment?

JOHNSON: Richard Edlund had enormous challenges in getting the equipment together. For a start, we anticipated that we were going to get the optical printer finished earlier than we did. And yet, in the circumstances, it works beautifully and we are beginning to make up time, even though we thought we were going to have it a month earlier. We've also had problems with suppliers who sent us defective pieces of equipment, and that really didn't help matters. So it's been quite a struggle for everybody and we've all been working very hard. Most everyone has been on a six-day week working long hours. The Optical Department is working 24 hours a day and will be doing so right up to the end. Obviously the bulk of the pressure is on them now, having to get all of the composites done, whereas before it was on the Camera Department. Then, too, we've had electronics problems with some of our new equipment. It's not easy to shoot when you're debugging equipment at the same time. So it's been a bit of a worry, but we've got our fingers crossed.

QUESTION: You're such an old hand at this kind of work that I suppose there's very little that seems new to you, but is there anything unique to this project, compared to what you've done before?

JOHNSON: The most unique thing is probably the fact that we have the motion-control equipment and the editing facility and the Optical Department all in one building. We also have our own developing equipment for our separations, which means that there is a much more rapid turnaround in getting things done. On a project like this there are always things that don't quite work and you have to run them through again. In the past this has always been a very time-consuming thing, but here, where we can look at what we've got and then

Continued on Page 603

The Sachtler 7+7 fluid head: Internally adjustable for neutral counterbalance with long and short lenses and with various cameras. Seven distinct and repeatable fluid drag settings for pans and tilts.

Part of a system of *modern* claw-ball fluid heads and tripods, and intelligent accessories.

The 7+7 fluid head as seen here weighs 5 lb. 14½ oz.

That's with the No. 1 camera platform, *without* the quick-release plate, pan-handle or claw-ball tie-down knob. *With* those, it weighs 6 lb. 14 oz., including the standard-equipment Sachtler claw-ball base.

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Choice of 3 camera platforms;
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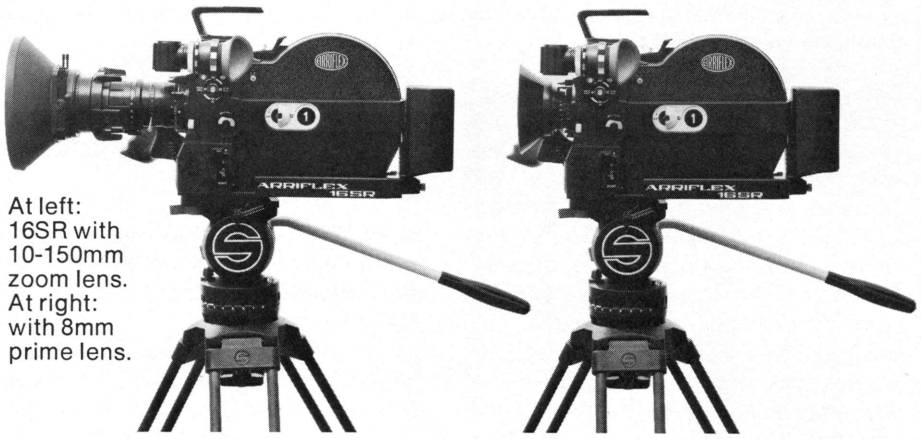

At left: 16SR with 10-150mm zoom lens. At right: with 8mm prime lens.

Different centers of gravity—same position on head

Changing to a heavier lens shifts the center of gravity toward the front. So does adding a zoom motor or production mattebox.

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No sliding platform. No figuring out which socket to use. And when you tilt, the camera stays where you set it, locked off or not. (That's provided your camera's weight/CG-height ratio is within the 7+7's range, of course.)

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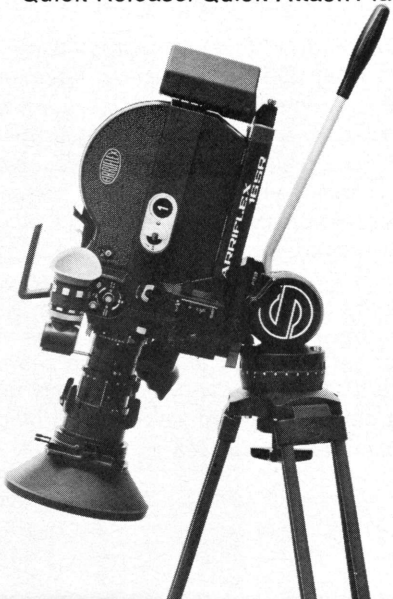

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As you can see, it's around 150°. By tilting the head (on its claw ball) 15° to the front or back, you get 180°.

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INDUSTRY ACTIVITIES

AN EXCHANGE OF MEMORABILIA

Grant Loucks, president of Alan Gordon Enterprises, Hollywood, California, presented David Samuelson of Samuelson's Film Service Ltd., London, a 1942 vintage 35mm Cunningham Combat Camera, during Mr. Samuelson's recent trip to the film capital. The Cunningham Combat Camera was designed during the early part of World War II for use as a field camera by U.S. combat photographers; it incorporated several technical innovations which were well in advance of its contemporaries. Both David Samuelson and Grant Loucks have extensive collections of motion picture memorabilia.

•

OWEN ROIZMAN, ASC, TO DIRECT JUNE WORKSHOP

Academy Award nominee Owen Roizman, ASC, will conduct a one-week workshop this summer in cinematography, lighting and advanced production techniques, June 8-14 at the Maine Photographic Workshop in Rockport, Maine.

Roizman, whose work includes THE EXORCIST, THE FRENCH CONNECTION, NETWORK, THREE DAYS OF THE CONDOR and the recently released ELECTRIC HORSEMAN, will spend the entire week working with professional filmmakers on technical and artistic aspects of cinematography. William Fraker, ASC, will conduct a similar workshop at the end of the summer, August 31 to September 7.

Each of these workshops is limited to 60 participants, and early application is recommended, as these courses are always full. Course costs are $350. Accommodations, application and travel arrangements are available by writing or calling the Maine Photographic Workshop, Rockport, Maine 04856. Phone: (207) 236-8581.

•

CONTINENTAL CAMERA SYSTEMS MOVES TO NEW HEADQUARTERS

Continental Camera Systems of Van Nuys is pleased to announce they have completed their move into their new corporate headquarters at 7240 Valjean Ave., Van Nuys, California 91406.

This move brings all of Continental's divisions under one roof including R & D design, manufacturing, sales and rentals. This expansion has enabled Continental to complete its present commitment of equipment sales and to concentrate on completing several new exciting projects, such as a unique underwater system called Sea-Cam, several new types of Pitching Lens systems, a new helicopter mount design and a new ultra light-weight 35mm, 400' coaxial magazine camera to be released in January 1980.

Continental's phone number remains the same, (213) 989-5222. ■

In a graceful gesture of "hands across the sea", Grant Loucks, president of Alan Gordon Enterprises, presents David Samuelson of Samuelson Film Service Ltd., London, with a 1942-vintage 35mm Cunningham Combat Camera, designed for use by U.S. combat cameramen in World War II. It will be on display in Samuelson's museum of cinema memorabilia.

COMPOSITE OPTICAL PHOTOGRAPHY FOR STAR WARS THE EMPIRE STRIKES BACK

A specially designed anamorphic reducing lens and computer-controlled optical printer combine to extend the frontiers of photographic effects

By BRUCE NICHOLSON
Optical Photography Supervisor

The composite-optical photography on THE EMPIRE STRIKES BACK represents about 1½ years' work at George Lucas' San Rafael Special Effects facility "Industrial Light & Magic." During this time period, the facility was physically set-up, equipment was designed and built, compositing procedures were researched and developed until we arrived at a photographic system that could successfully produce the effects Mr. Lucas had in mind.

Since the majority of shots take place on the snow planet "Hoth", our matting problems became particularly difficult. There is simply no room for error when attempting to disguise the matted edge of the foreground subject against the white background.

Most of the matted elements, such as spaceships, asteroids, live action characters, and even birds were shot against a blue screen. Other elements such as background asteroids and planet surfaces were shot against a black backing. Some shots called for studio-generated plates to be combined with matte paintings.

Some of the Walker sequences called for miniatures to be shot on the animation stand, and then matted into a Norway background with a foreground cockpit. These miniature Walkers had to register exactly to the helicopter-shot background plate.

The asteroid sequences called for many separately filmed elements to be matted into a shot lasting not more than four seconds on the screen. The snow battle sequences also required many elements such as Speeders, Walkers, animation flak, lasers, and explosions to be combined into a cinematically believable shot.

The optical department was designed to minimize the amount of dirt and dust contamination of the original negative and the various intermediate stocks used. The room was set up with positive pressure and filtered air to eliminate dust. Temperature and humidity were closely monitored to insure proper conditions for film storage.

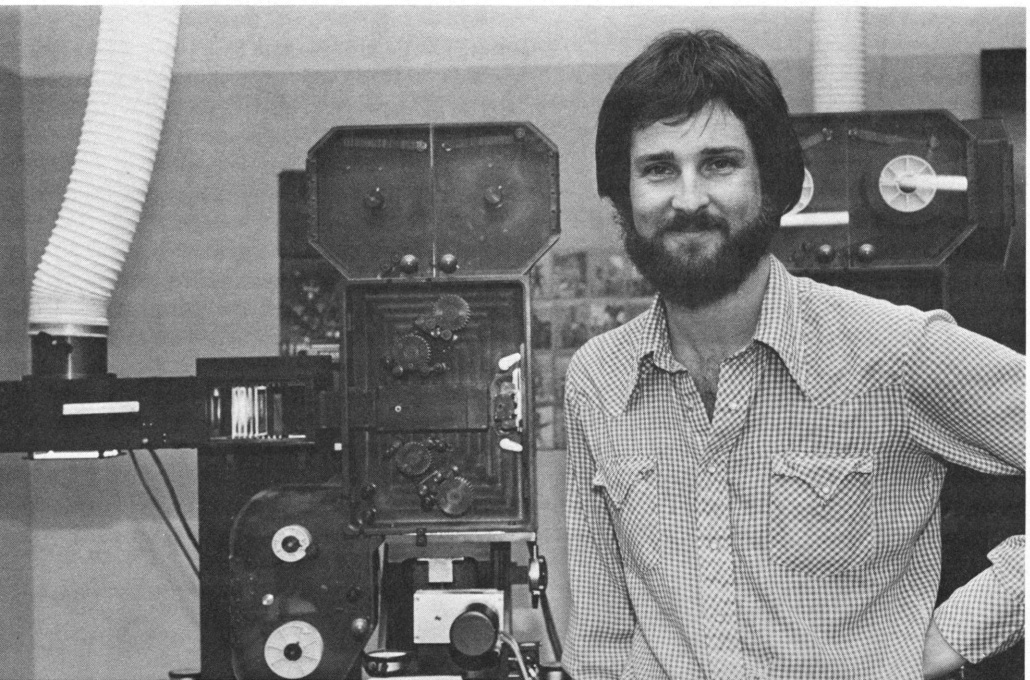
In-house processing became a necessity for us because of our lack of proximity to a major lab. We would have lost crucial time had we not processed our intermediate elements in-house. We purchased a Treise Processor, and, with their help and expertise, were able to set-up a black and white processing lab adjacent to the optical department. This gave us better control over our printing elements, with the added convenience of being able to redo them quickly should any problems arise. We found, during the course of the show, that contrast changes were needed for certain shots. With the Treise, we could wedge and shoot with very little hair-pulling. Many thanks to Tom Treise and Company.

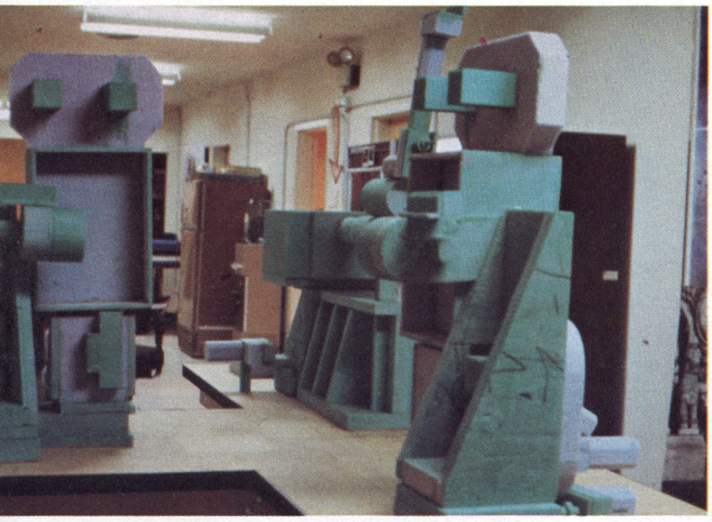
As on the first show, STAR WARS, we decided to use the VistaVision format for our effects. Since the original live action would be shot in Panavision with only the effects shots in VistaVision, our optical composite printer would need to reduce the VistaVision printing elements to a Panavision duplicate negative. We decided to have an anamorphic lens designed to accomplish this function. The ideal was to use an anamorph that was so sharp that the effects shots and live action would be indistinguishable. Considerable research and time was put into this lens, and, thanks to the efforts of David Grafton (designer) and J.L. Wood (manufacturer), we were able to come very close to achieving this ideal. Line resolution for this lens is actually better than that of the Nikkor lens we use for "flat format" printing. In fact, initially at dailies, George would find some of the composites unacceptable because the image appeared too sharp! We would then have to desaturate to achieve the look he sought. Nonetheless, the amount of sharpness we were achieving with the anamorph gave us more latitude to interpret the image. This is quite an accomplishment for a duplicating system!

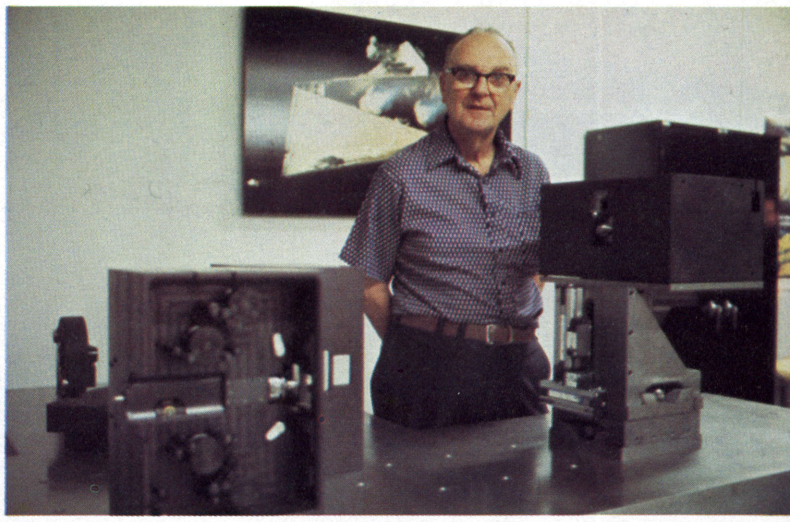
The printer we designed around the anamorphic lens also represents a considerable improvement over the technology applied to optical printing in the

Continued on Page 571

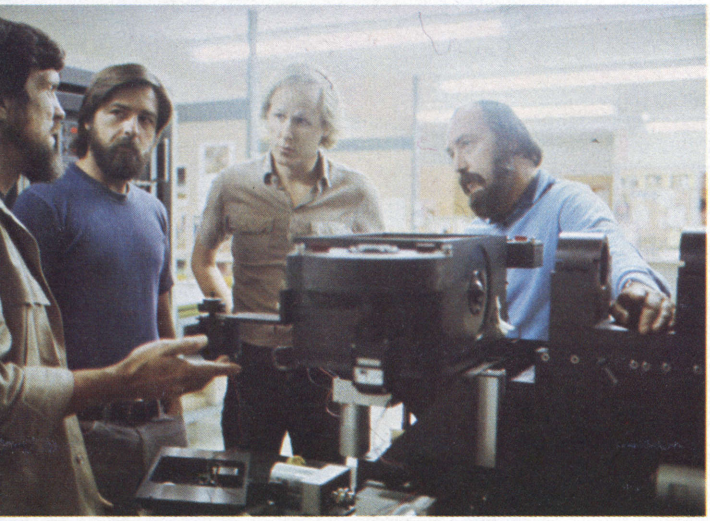
Bruce Nicholson, Optical Photography Supervisor on THE EMPIRE STRIKES BACK, shown with the optical composite printer designed and built at Industrial Light and Magic. The computer-controlled device is of the beam-splitter type, with two projectors on each axis. It was used extensively to reduce VistaVision printing elements to an anamorphic dupe negative.

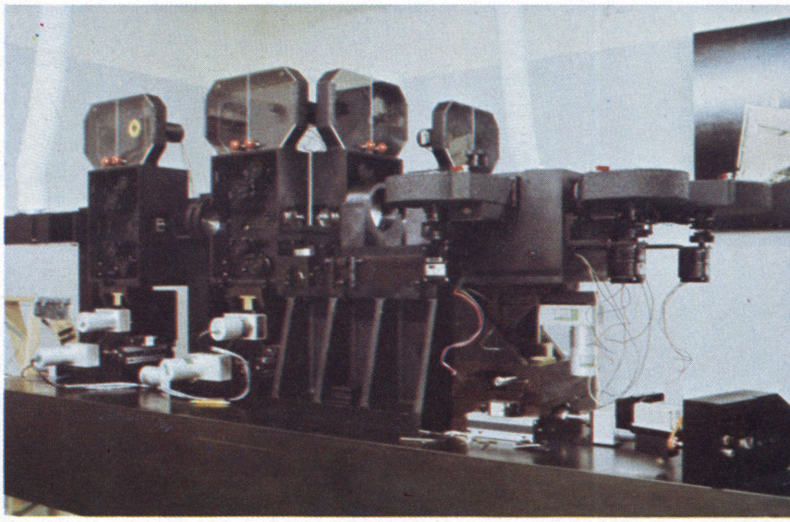






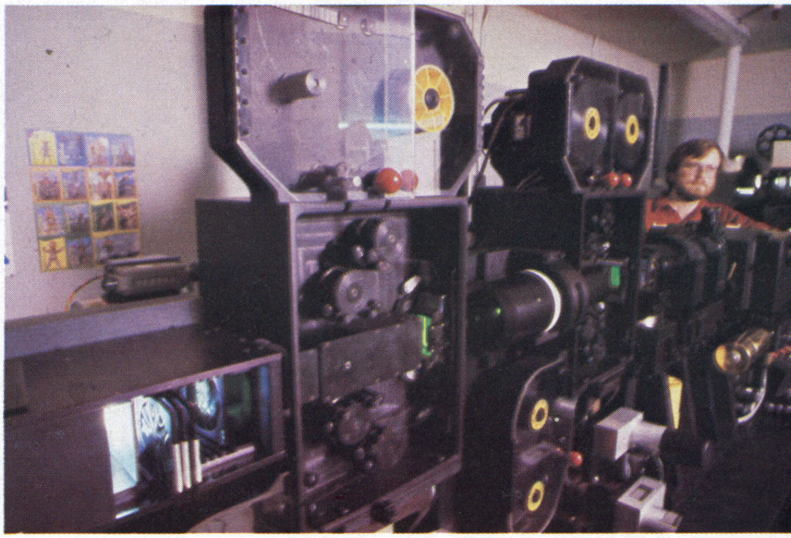
(LEFT) Quad Printer was first mocked up in Styrofoam by Stuart Ziff. (RIGHT) Hollywood master machinist George Randle notes early installation of camera and projector he provided for ILM custom-built Quad Printer. The printer was designed around a custom-built anamorphic lens. The printing functions were all computer-controlled. A small micro-processor could be programmed to add or delete certain functions considered necessary or unnecessary. (Photographs: Howard Stein.)





(LEFT) Richard Edlund (Visual Effects Supervisor), Mike Bolles (Design Engineer), Neil Krepala (Matte Cameraman) and Gene Whiteman (Machine Shop Supervisor) discuss the Quad Printer. (RIGHT) The Quad Printer in the process of being built. This optical printer was designed as a beam-splitter type, with two projectors on each axis. (Photographs: Howard Stein.)

(LEFT) Bruce Nicholson, Optical Supervisor, inspecting ILM custom-built Quad Printer. (Photo: Terry Chostner.) (RIGHT) Ken Smith, Printer Operator, running the Quad Printer. (Photo: Nancy Moran.) Some of the scenes in EMPIRE had as many as twenty-five separately filmed elements in them. Using separation positives, this would normally require 75 passes through the camera, but the beam-splitter halved that number.



Continued from Page 553

of time to use it on location.

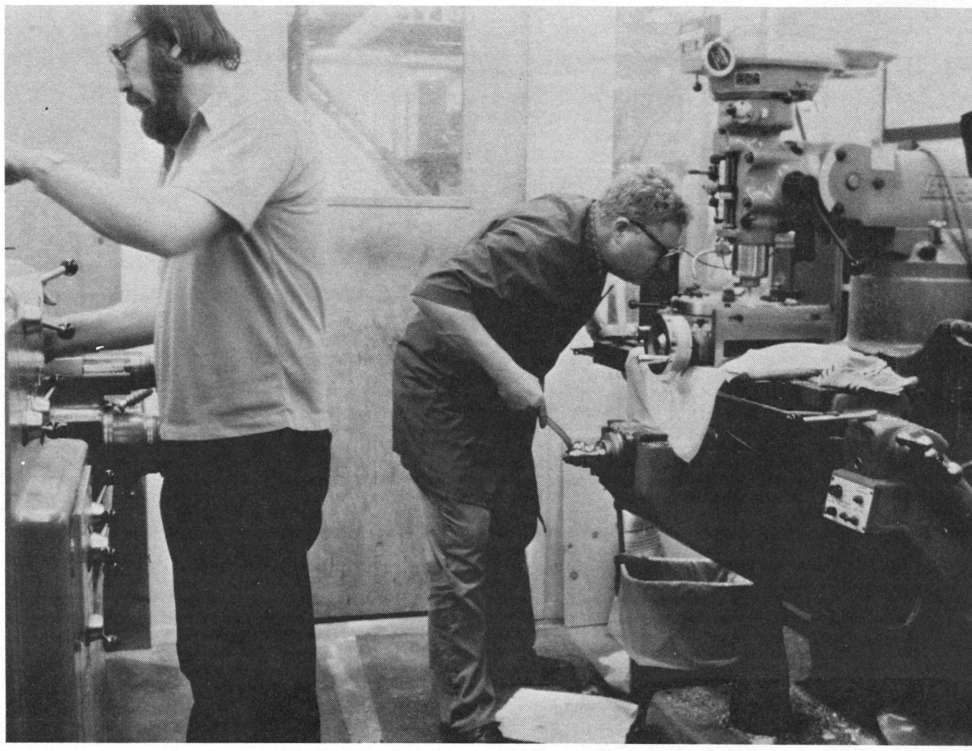
At the same time, the sound speed version was being built with a motion control system that would enable us to photograph motion control work in the field. We could then bring the unit back to the stage and it would remember the exact tilts and pans which the operator had made. The operator would not necessarily even be aware that it was a motion control camera. The system would merely memorize what he did and capture that information on magnetic tape. We could then bring the data back and put the camera in a miniature set on our stage and do a move that would fit exactly to that which had been made on location. That did not get finished in time for location shooting, but it was used in-house for shooting all of the stop-motion work.

That multiplied our motion control cameras to three, the first one being the Dykstraflex, which was used for STAR WARS, and its sister camera which runs on the same information base, although it looks entirely different. It will repeat the same move that the other camera made, so that a matching background can be photographed on the second camera. This allows the main camera to go on shooting the more complex shots or those that require greater flexibility.

Meanwhile, the high-speed camera was being developed and worked on by Gene Whiteman and master movement wizard Jim Beaumonte. We knew the design of the movement would be capable of at least 100 fps, which we have achieved at this writing, but we are planning further modifications to some of the parts and the movement in order to make the camera run at perhaps 150 fps—if we are lucky.

This meant that we now had four cameras. Then Brian Johnson found five Technirama cameras in England and we have been systematically dragging those out, one at a time, and more or less retuning them and putting up-to-date electronic drive systems into them in order to increase the number of cameras that we have available, so that we can commit a camera to each shot.

The system that we have is capable of a very high rate of production in that we can program a shot in, say, 15 minutes, if it's a very simple shot. A really complex shot may take two hours to get the motion program down. Then, once that is done, we can photograph a black and white test, develop it in-house, and look at it immediately. If it looks good, then we go on with it. That is fine for the main type of production shots (which involve careening spaceships, in a lot of cases) or background paintings or miniature shots in one form or another.



Gene Whiteman, Machine Shop Supervisor, and Udo Pampel, Machinist, hard at work in the ILM machine shop. (BELOW) Udo Pampel machining special shutter for the Empire camera. The extra cameras built at ILM multiplied the number of effects that could be worked on simultaneously and made more efficient use of personnel. (Photos: Howard Stein.)

The thing is that there are certain shots which require tweaking. Because they are R & D shots of a type that you haven't exactly done before, you are taking a chance. In order to do that kind of shot, you have to commit a camera to the shot for a period of time, and if you don't have enough cameras to commit to such shots, then you have to shoot the scene, give it your best shot, and go on. The more cameras we have to commit to shots, the less personnel we have to tie up on each set-up. One person can work

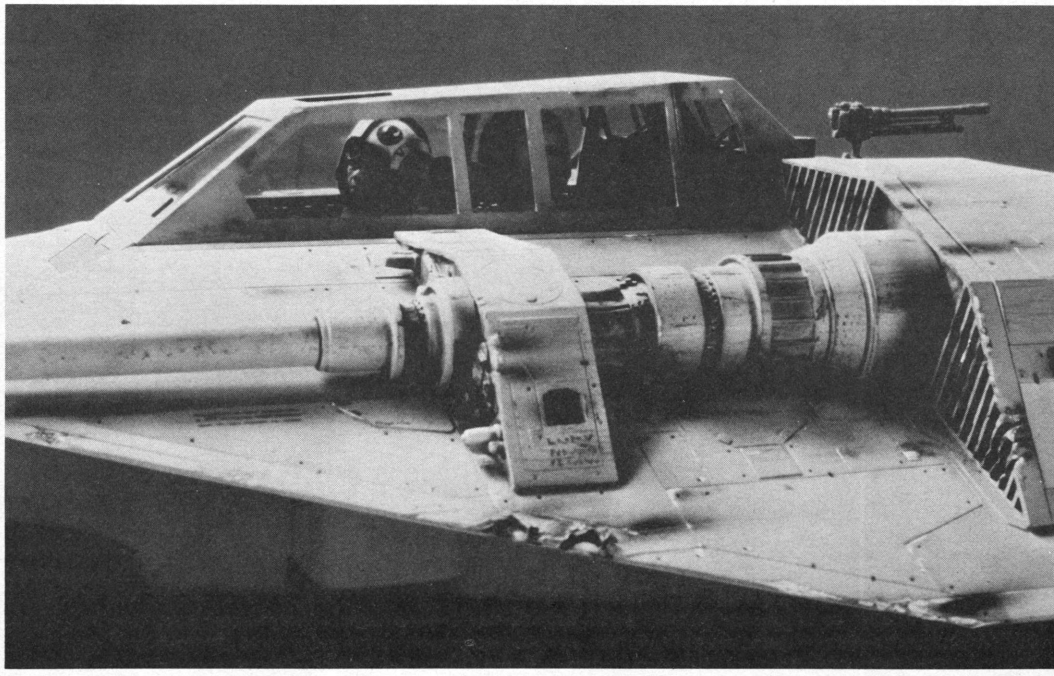
from set-up to set-up. He can do a test on one set-up, while he moves on to another set-up and leaves the first camera where it is. This system enables us to try a greater variety of shots and spend more time on certain problems that require finessing. We'll have probably eight cameras before we are finished.

This brings me to the new VistaCruiser camera which we are now working on. It will have an 80-foot track, as opposed to the 42-foot track which we have now. It will have a longer boom arm, be a steadier camera and have a greater film capacity. It will also have a better video viewing system, a better follow-focus system and a better motion control system.

Our final vision (or our *fantasy*) is to make an electronic control system which will feed all of the cameras, including the printer, the Oxberry animation stand and all of the departments, so that the various pieces of equipment can "talk" to each other. For example, let's say that there is a shot which, because of limitations of space or the length of the track, you can't make as long as is needed. Then, you would either want the printer to continue moving back on it at the same rate the camera was going and maintain a similar trajectory, or you would want the Oxberry animation camera to continue on, or you would want the Oxberry to shoot the background—but the various pieces of equipment would all be speaking a common language. This means that we could move back and forth from department to department and thereby increase the scope of the type of work that we can do.

Actually the tracking camera we built for STAR WARS is fairly primitive. At the time it was the best we could do, being pretty much under the gun, as we were—and we didn't have the success that we now have behind us. We were all learning, so we took the most conservative approach in terms of building the system. I think that was a really good move because, first of all, it worked when we plugged it in and we didn't have the heartaches of finding out that it wouldn't work. We knew that once we learned how to use the equipment, it would be much more of a sure thing—so there is a lot to be said for that approach when I lay back and talk about our "fantasy" system.

You have to work into a system like that slowly, a step at a time, because if it gets too complex, you will wind up with something that won't work unless it *all* works. We don't want to get into that position, because we all know that when you have a lot of components that are all prototypical, you're going to have problems and there are going to have to be people working out those problems all the time.



Large-scale Snow-Speeder with motorized capability for the pilot's head movements. Impeccable attention to detail in every aspect of production is what lends the intricate effects their remarkable degree of realism on the screen. In no instance does the "machinery" behind the scenes become obvious. (Photo: Howard Stein.)

So if you try to build the thing all at once to be the "ultimate" system, you will wind up failing. I think you have to go a step at a time.

The system that we have now is not a computer system. It's a solid core memory system, and the electronics very precisely remember what you've done in programming a shot. It's all done by humans and not by computers—which brings us to the subject of our philosophy of motion control.

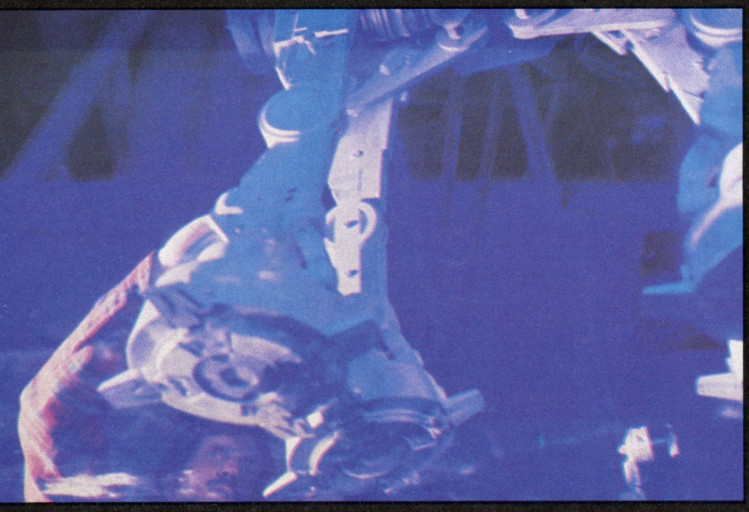
I would say that there are two basic philosophies of motion control. One is the concept of letting it all be done by mathematics, or depending heavily on the mathematically-based move. The other concept allows the human being to program the move. When the mathematician programs the move, it comes out in a perfectly mathematical parabola. The shot is so perfect that it is not interesting. The trajectories are all perfect—and predictable. On the other hand, if you enter the human element into it—which is what you'd really prefer if you wanted the material you are photographing to have something of the look of a guy out there with a hand-held Arriflex shooting it—then you would have a certain suspense. It would be very peripheral; you wouldn't really understand it; you wouldn't know why it was there—but you would know that the shot had not been done by a machine. Therefore, your material would have an effect that is altogether different from that of material that has been programmed mathematically. Not that there aren't certain cases in which you would want to use mathematically-based material. There are specific times when you do want to have that precise kind of control and it would be very agonizing to try to get the other way. But, in our operation, we tend to lean toward the human operator interface, rather than the mathematical interface. However, the new system that we are contemplating will be able to do both, and it will have an essentially unlimited number of channels.

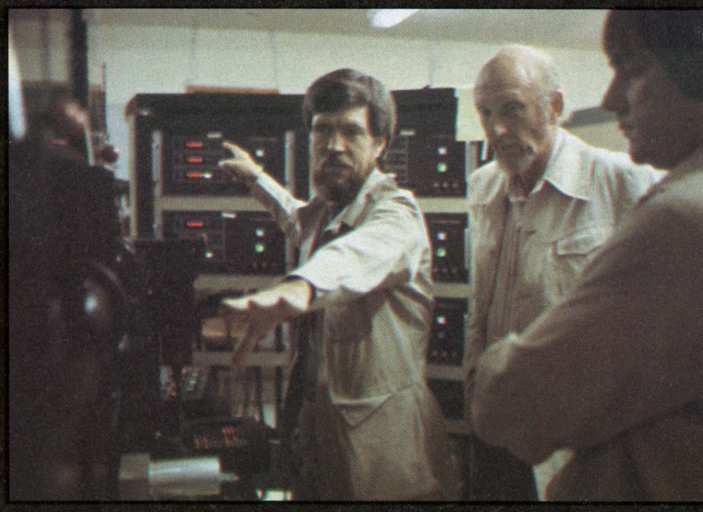
The system that we have now has twelve channels. You have your pan, tilt and roll. Then you have your track (for the camera) and your model track and, let's say, three functions for moving the model in X, Y and Z, pitch, yaw and roll.

Most of the time you don't need all of those channels. Almost invariably you use pan and tilt; not always do you use roll; not always do you use boom, but you always use the track. I would say that we use five or six channels per shot, on the average. I've only had two or three shots where I've used all twelve channels. But they can come in handy when we have situations where we might want to motorize a lighting effect, or there is a miniaturized actor as a model that turns his head or lifts his shoulder or does something that takes the deadness out of the stick figure.

The new system will be modular. It will have four-channel components, so that you can add more axes in motion simply by adding more banks of computer cards. What we are really trying to do—as much as we are involved in equipment or "technolust"—is to make the system fun

(LEFT) Producer Gary Kurtz discussing full-scale Millennium Falcon model with Richard Edlund and Brian Johnson. Dick Gallegly, production manager, stands in the background. (Photo: Miki Herman.) (RIGHT) Edlund pulls back, while Dick Dova supports the "luge" rig for the new high-speed camera. A plexi-glass case was built over the camera to simulate Luke's Speeder cockpit window for POV shot of Speeder crashing into the snow. (Photo: Howard Stein.)





(LEFT) Richard Edlund discussing shot involving large Snow Walker. (Photo: Howard Stein.) (RIGHT) Edlund, Director Irvin Kershner and Brian Johnson discuss ILM Quad Printer in the Optical Department. (Photo: Howard Stein.) The ILM facility in San Rafael, California, where all of the intricate effects were shot, had to be designed and built from scratch for this production.

(LEFT) George Lucas discussing a shot angle involving the Rebel cruiser with Richard Edlund and Steve Gawley, Model Shop Foreman. (Photo: Miki Herman.) (RIGHT) Empire camera, built in three months' time, being inspected by Edlund, prior to being sent to Norway. A prodigious accomplishment in design and construction, the camera was finished just in time for location shooting. (Photo: Howard Stein.)

to use, so that the operators can exercise their ideas and add to the product in the most facile manner.

To execute the complex three-dimensional stop-motion animation in THE EMPIRE STRIKES BACK, we have Jon Berg and Phil Tippett. These are two animators who have knocked their heads against a wall for years and years and have really learned their art and they are truly adept men. I think they are the greatest and they have really done some marvelous stop-motion work on EMPIRE, including quite a bit of pioneering in the art.

I've already talked a lot about our main tool, which is motion control photography and which allows us to repeat identically the same move once it has been programmed. The other major tool that goes hand-in-hand with that is the blue screen process.

I had considerable experience with the blue screen process during the years of 1963 through 1967 when I was working with Joseph Westheimer, ASC, who was my mentor in the business. I was a photographer prior to that and, through his good offices, I worked with him for four years and learned a great deal about special effects. We started working out the early problems of blue screen while I was associated with him.

I became extremely enamored of the process, because it enables one to extract a perfectly-fitting matte from the same negative that the image is on. There are many ways of doing blue screen, and every self-respecting optical house has its own blue screen technique. They are all somewhat different. Some of them work well and some of them work well in certain circumstances and not in others. Some don't work at all.

I remember when I first suggested to George Lucas that we shoot all the STAR WARS material in England by means of blue screen, rather than front-projection. I knew I was really sticking my neck out, because there is nothing that makes a director more paranoid than going to dailies and seeing all of this perfectly timed and matched action with a blue background that, by itself, is totally useless. He is, thereby, putting himself completely in the hands of the person who is going to do the special effects for him. Since, at that time, we hadn't had any experience with him, and we were learning also, it was rather tenuous. But we wound up doing it that way, since the front-projection techniques didn't work out to be logistically possible.

We worked out a system of doing blue screen on STAR WARS and it was adequate for the type of work we were doing at the time, which was mainly spaceships over star backgrounds. In deep space you have a lot of license that you can take because nobody has ever been there and we don't really know what it looks like. Besides, all you have to do is matte out stars to keep them from going over an object and do it so that the matte line won't show.

Crew working on a remake of Wampa shot in Marin County. The Wampa is the mythical white, furry and fanged beast that fells Luke Skywalker in the frozen wastes of the Ice Planet. Left to right: Bill Neil (Camera Operator), Phil Tippett (Animator), Mike Bolles (Design Engineer). (Photo: Terry Chostner.)

There are some perfect matte shots in STAR WARS. The system that we worked out in the meantime is based on a continuous tone film as the matting stock, rather than high-contrast, and I cringe at the idea of using high-contrast at all in the matting process, except for garbage mattes or something like that. The thing is that the edge quality of high-contrast film is so different from that of color negative that you wind up clipping the matte lines and clipping the edges of the film. That works out pretty well in a shot that moves along (if you have a one-second cut you may not notice it), but if you get into a shot that plays for any length of time on the screen, it doesn't work when it slows down past a certain point. So we've developed the system now so that we are able to achieve perfectly believable matte shots in most cases, and we would, I think, be able to do it in *all* cases if we had as much time as we'd love to have.

The blue screen process is dependent upon good photographic technique, probably more so than it is on the printer that you work with. But the general optical systems that are available and are designed basically for the workhorse types of opticals (fades, dissolves, reductions, flops and the various blow-ups for getting rid of the mike booms)—that type of printer is not acceptable for composite photography, if you are doing a great amount of it.

Consequently, we designed a printer for composite photography that has a couple of basic differences from the standard optical printer. We were able to design a printer for doing blue screen work and it has the finest possible optics that could be achieved within the time frame. In fact, even if we had had more time, I don't think we could have gotten a better lens.

We designed what is actually a four-headed, optical, beam-splitter printer. It takes two pairs of VistaVision projectors, each pair with a relay lens that is distortion-free between it and an anamorph that then takes the VistaVision image and reduces it to a 2-to-1 anamorphic ratio suitable to intercut with the film which we shot in Panavision. This lens has exceeded our expectations. In about 30 to 40 percent of the shots we have actually had to degrade the image in order to make it look real. It looks too crisp in certain cases and we have been in a position of degrading the image to make it fit, rather than degrading the background to make the image work with it. So I think we've achieved a marked degree of success with our new printer and the results will show on the screen.

Continued on Page 604

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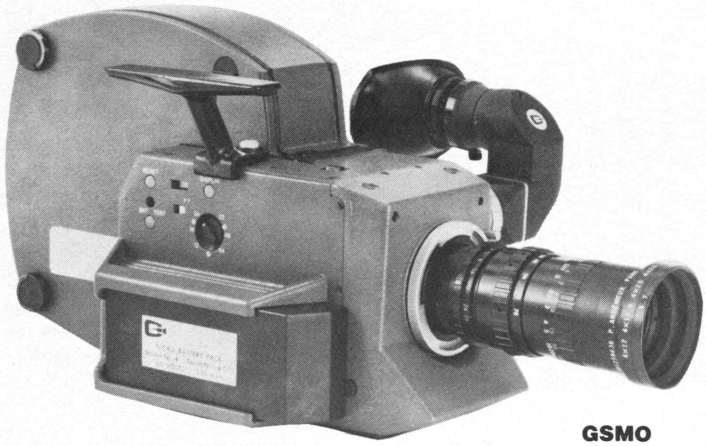

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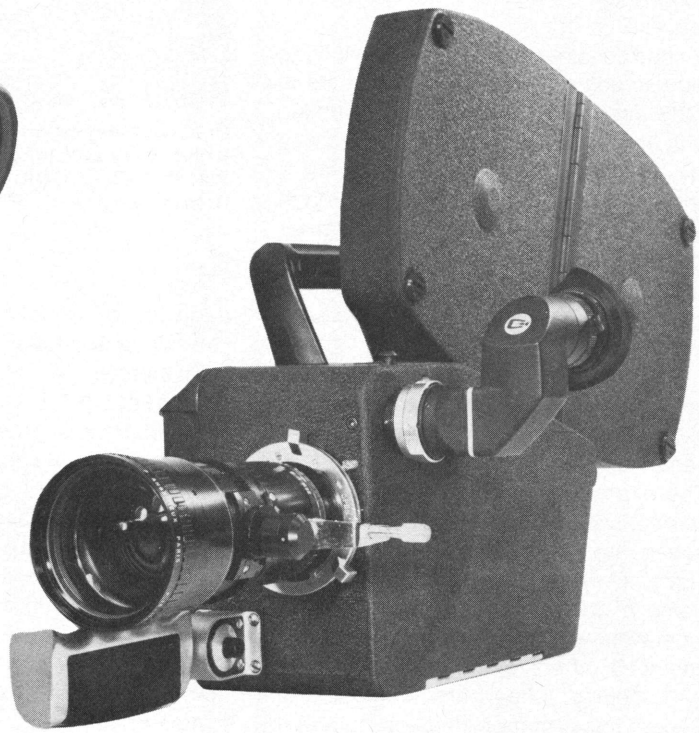

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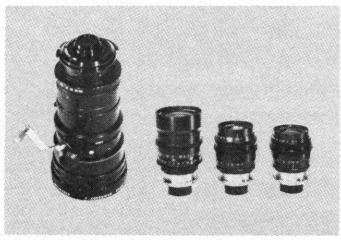

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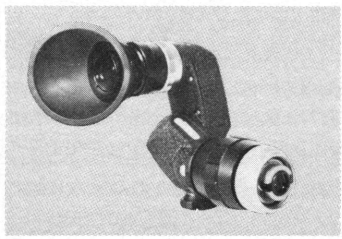

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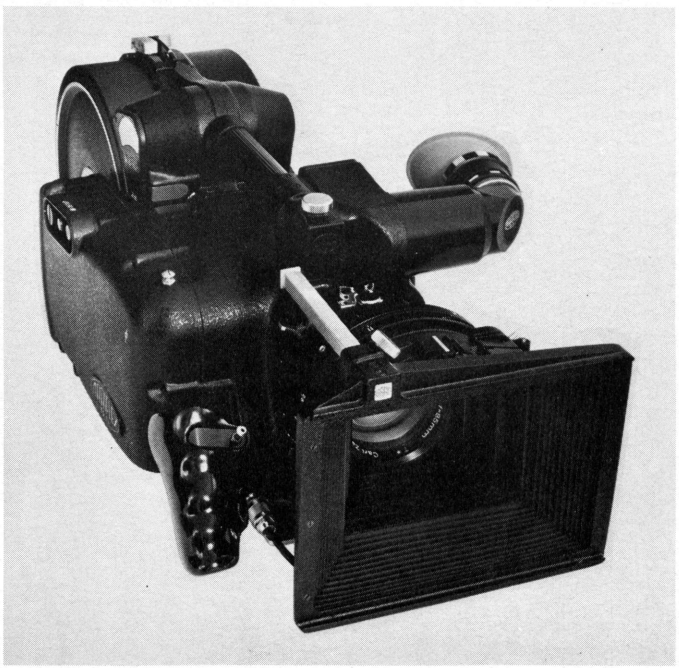

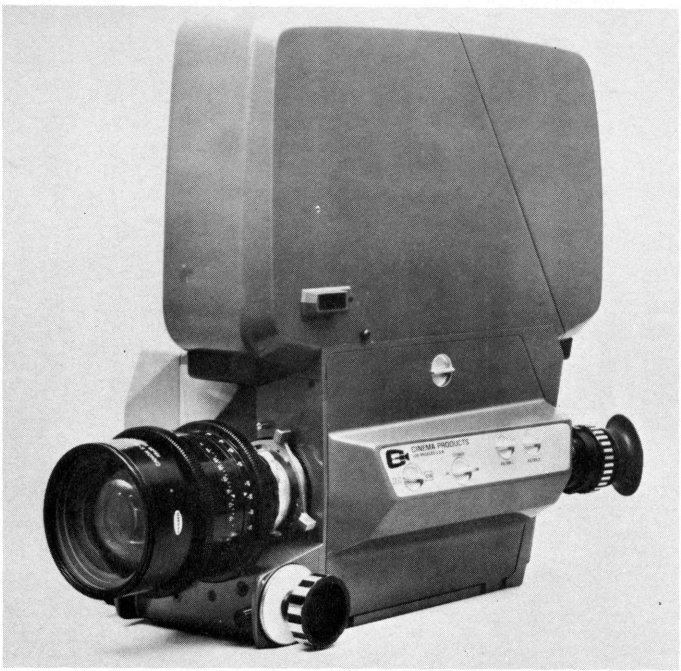

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COMPOSITE OPTICALS FOR "EMPIRE STRIKES BACK"

Continued from Page 562

past. The printing functions were all computer-controlled. A small microprocessor could be programmed to add or delete certain functions considered necessary or unnecessary. This microprocessor could then give us greater flexibility with our printing controls as the job demanded. For example, all the skip print and double print functions were programmed after the printer was up and running. ILM's electronics department, headed by Jerry Jeffress (hardware) and Kris Brown (software), was responsible for these capabilities.

Our optical printer was designed as a beam-splitter type, with two projectors on each axis. Many of the shots we dealt with on EMPIRE had so many elements in them that a beam-splitter printer was considered to handle these complex shots more conveniently. Some of the asteroid sequence shots had as many as twenty-five separately filmed elements in them. Using separation positives (three records per element), this would constitute seventy-five passes through the camera. However, with the beam-splitter arrangement, the number of passes were halved, with one set of separations and their respective mattes run on each axis. This saved us valuable printer time, and most of the multi-element shots in the show were printed in this manner. Richard Edlund, Visual Effects Supervisor, came up with this approach for our composite process.

With the many white background shots that we would be dealing with, we felt it would be essential to position each element individually to its matte. On the first show, we were only able to obtain one fit for a key foreground subject; however, this time around, every matte had to fit as perfectly as possible.

We worked out a system in which our projectors were mounted on X, Y, Z axis slides which were hooked up to encoders which could monitor position to within 1/10,000th of an inch. This provided us with a very accurate matte positioning system as well as allowing for optical pans and moves. Our optical printer operators, Dave Berry, Ken Smith and Don Clark, did an outstanding job of utilizing the printer's capabilities to produce a successful composite.

I felt that soft-edge mattes would be the only means of achieving composites free from matte-lines. We therefore eliminated 5369 High Contrast Stock from our list. With a fast moving subject, like the spaceships we were dealing with on EMPIRE, the lower contrast stocks

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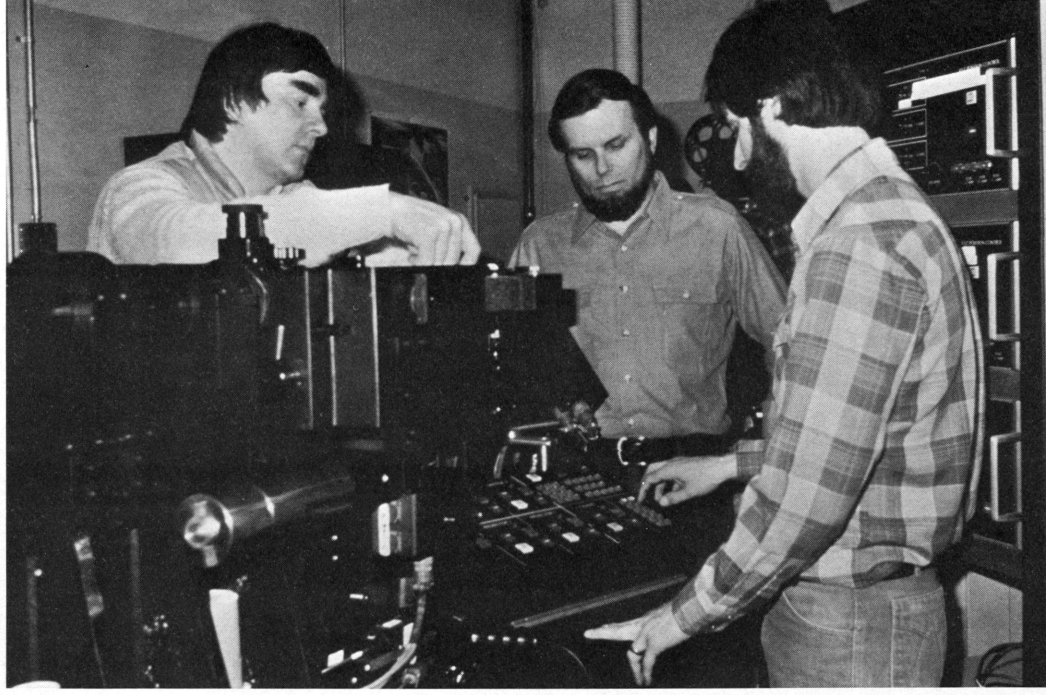
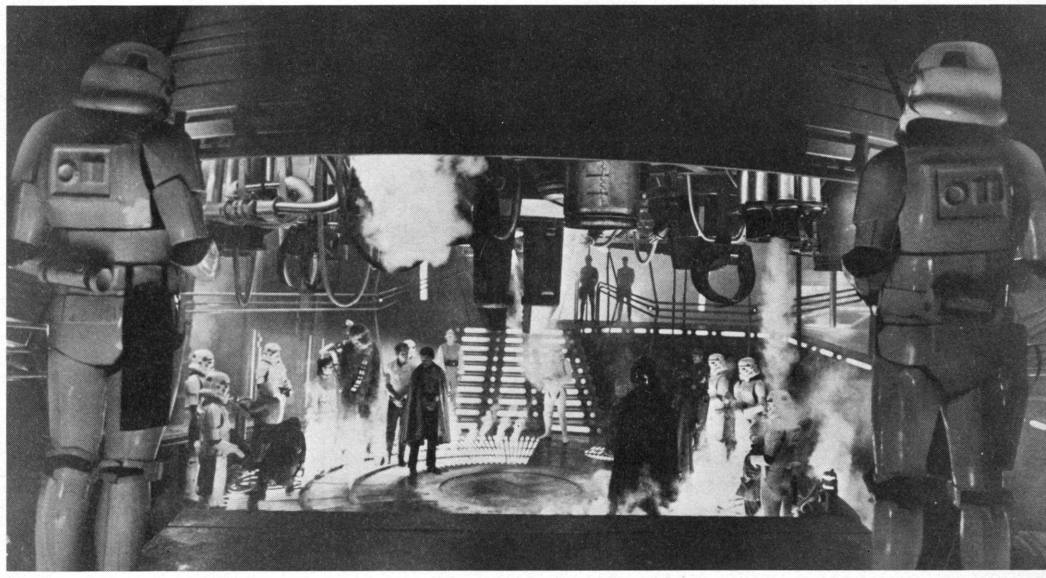
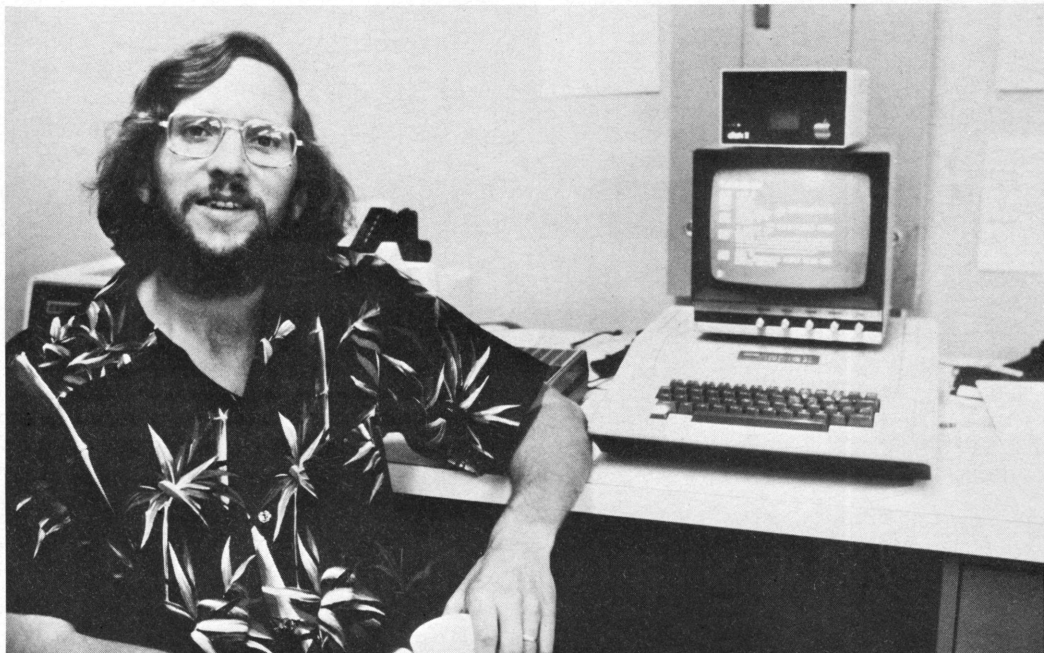


Special Visual Effects Co-supervisor Brian Johnson, Producer Gary Kurtz and Bruce Nicholson examine the new optical printer. (Photo: Jim Veilleux.) (BELOW) A scene such as this could be created in several ways. An easy, conventional method would be to shoot the foreground elements against a blue screen and matte in the background scene on the optical printer.



Optical Printer Operator David Berry, shown with "Apple II" computer which streamlined the line-up system by printing out the count sheets. This new-found capability eliminated many of the computation errors associated with generation of separation positives and their corresponding mattes, saving much time and cutting down monotony. (Photo: Howard Stein.)



EFFECTS PHOTOGRAPHY FOR STAR WARS THE EMPIRE STRIKES BACK

Fierce dogfights in space, huge machines that walk and spit death, weird beasties—all representing the art of illusion at its best

Dennis Muren, Effects Director of Photography on THE EMPIRE STRIKES BACK, was born in Glendale, California and attended Pasadena City College and California State University in Los Angeles.

Encouraged by his parents, who bought him home movie equipment, he shot home movies and, during a summer vacation, made a 16mm film about witchcraft called THE EQUINOX, which featured stop-motion and special effects. The film was given full circuit release. Muren has also worked on many commercials. His feature credits include STAR WARS and CLOSE ENCOUNTERS OF THE THIRD KIND.

In the following interview, conducted at Industrial Light and Magic, Inc. in San Rafael, California, during the final stages of production on EMPIRE, he discusses the challenges and techniques involved in filming the intricate miniature and stop-motion sequences for the film:

QUESTION: Can you fill me in a bit on the background of your particular function in the production of THE EMPIRE STRIKES BACK?

MUREN: It has been quite an elaborate project, complicated by the fact that we are working here in Marin County and had to set up this facility while the live-action shooting was going on in Europe over a period of many, many months. We began by having a number of meetings with the live-action Director of Photography, Peter Suschitzky, BSC, and discussing what he was going to be doing on his end and what we would be needing from him in order to make our material work. We attempted to coordinate all these different elements which would be shot on two continents, but which would end up here on the West Coast. We had to be very careful in taking note of what they were shooting over there and they paid a lot of attention in their shooting to make sure that we would be able to use their elements.

QUESTION: And were you actually able to make that system work without major problems?

MUREN: Actually, everything seemed to go pretty well. There were, inevitably, times when some shots were added that hadn't been anticipated, so we had to make do with footage and use it in a relationship different from what it had been intended for. For example, we sometimes had to inject an object into a shot that they hadn't thought they were going to need to put anything into. But, all in all, from an organizational point of view, everything went quite well.

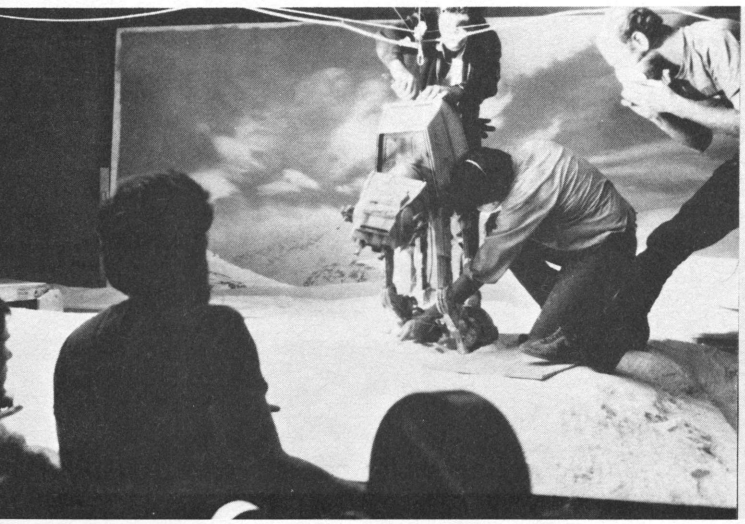
QUESTION: What were the problems of adapting your work to the photographic style of the live action footage?

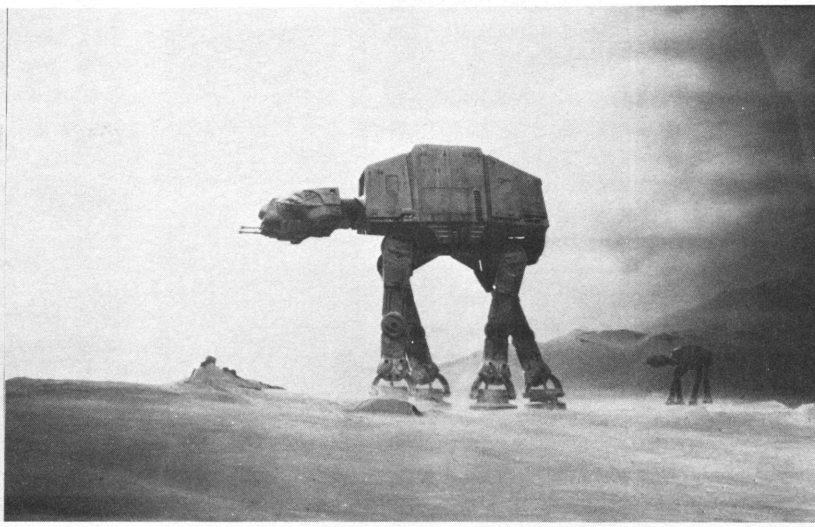
MUREN: The Lighting Cameraman in England was very much into soft lighting and very dramatic lighting, so we maintained that at our end, too.

QUESTION: The sequence involving the giant Walkers takes place on the dread Ice Planet, as I understand it, and you had quite a bit of work to do on that sequence. Can you tell me what some of your problems were?

MUREN: They shot a lot of Wesscam footage on that from helicopters and also a lot of ground footage. They had a lot of trouble on location in Norway because of changing weather conditions and that complicated things immensely for us in terms of matching. We ended up with footage for a sequence in which some shots would have bright sunlight and a blue sky, cutting directly to a white sky and a snowstorm in which you couldn't see 30 feet away. But in a way, that problem gave us the freedom to add something to that sequence that wasn't there

Effects Director or Photography Dennis Muren, shown with the "Empire-flex", the only *reflex* VistaVision camera in the world. Built at ILM, it took three months to construct, worked fine, and was delivered to the Norwegian location on time, complete with built-in heaters to enable it to operate at 30 degrees below zero.





(LEFT) Crew prepares Walker for collapse shot. Left to right (with backs to us:) Joe Johnston—Special Effects Art Director, and Richard Edlund—Visual Effects Supervisor. Left to right (facing us:) Ed Hirsh—Stage Technician, Jon Berg—Animator, and Steve Gawley—Model Shop Foreman. (Photo: Miki Herman.) (RIGHT) The Imperial Snow Walkers colossal, death-spitting machines on the screen, lumber in stop-motion across the miniaturized snowscape of the Ice Planet at ILM. (Photo: Terry Chostner.)

yet. We could literally take it any way we wanted. So we ended up adding a progressive blizzard to the sequence by means of our shots and George Lucas recut footage to accommodate this. As the sequence begins, there's a big storm front approaching in the background and the Walkers are in sunlight in the foreground. Then you see clouds beginning to form and the sequence ends in an overcast that makes the Walkers look very menacing and large and dramatic. That problem with the weather wasn't really anticipated, but it worked out nicely in that it gave us a chance do a lot. Mike Pangrazio did most of the backgrounds and Ralph McQuarrie did one of them—great stuff. A lot of people worked on that sequence. Phil Tippett and Jon Berg did the stop-motion animation.

QUESTION: You did the Walkers and those mythical Ice Planet animals, the Tauntauns, in stop-motion; isn't that right?

MUREN: Those and the Probot shots. A Probot is a kind of robot probe that the Empire sends down to Hoth, the Ice Planet, to scout for life and find out where the Rebels are. It's hard to explain just what a Probot is, but it's like a multi-armed little ball that walks around. It's about six feet long and floats in the air and these arms sort of direct it along the landscape. It supposedly sends messages back up to the Empire so that they can find out if there is life.

QUESTION: Stop-motion is such a highly specialized and demanding type of animation. Where did your background in that come from?

MUREN: I've got an extensive stop-motion background, having come up through Cascade Films and having been associated for a long time with Phil Kellison, who worked with George Pal on the Puppetoons. A lot of the guys here (Jon Berg, Phil Tippett, Ken Ralston) came up through Cascade and we've all been friends for 15 years, doing stop-motion. I worked on STAR WARS and did motion-control work all the way through that, and the same with CLOSE ENCOUNTERS, but with the success of the chess sequence in STAR WARS, George decided to do some stop-motion in this one. So Jon and Phil, who had worked on STAR WARS, came back to do it again.

QUESTION: Stop-motion, it would seem to me, is a particularly nerve-wracking pursuit. Doesn't it take a huge toll in terms of stress?

MUREN: Having been involved in a lot of stop-motion work, I've felt that there were a number of stress problems that had to be overcome, and some of those problems stem from just the tension of approaching a shot. You don't begin a stop-motion scene and quit 30 minutes into it and wonder how you are doing. You've got to keep going on it, and if you make a mistake, you won't know about it until you see the completed shot. That being the case, there is some degree of tension and hesitation in approaching the work—at least, that's true for a number of people. So I thought that, in order to relieve as much of that tension as possible, the animator should only be involved ith animation when he is doing this kind of work. He shouldn't have to worry about the camera or the lights or anything else. That means that the set-ups are made in such a way that he can easily walk into them and walk out without tripping over anything. That leaves him free to concentrate his attention on the things that will help the animation.

QUESTION: That would seem very effective by way of easing certain tensions, but what about the problem of having to wait so long to see the completed scene?

MUREN: Having to wait a whole day to see it does present a problem and there's much to be said in favor of immediate feedback. So we came up with two solutions which we are using. One is to shoot with black and white film, develop it instantly in-house and see the result 15 minutes after the end of shooting. The other approach is to use the Lyon-Lamb Video Animation System, which involves a video tape that is played back at 24 fps electronically. We used a Sony system similar to this at Cascade ten years ago, but it ran at 30 fps and was rejected because it was electronic, but a piece of video equipment that plays back at 24 fps allows the animator to get an immediate feedback and, as a result, become less concerned about starting a shot. He can try something 20 times in one day. Anytime he feels like it he can walk over and turn the equipment on and try a motion he may be thinking about. It's no big deal to do that. He doesn't have to load a camera. He can do it all by

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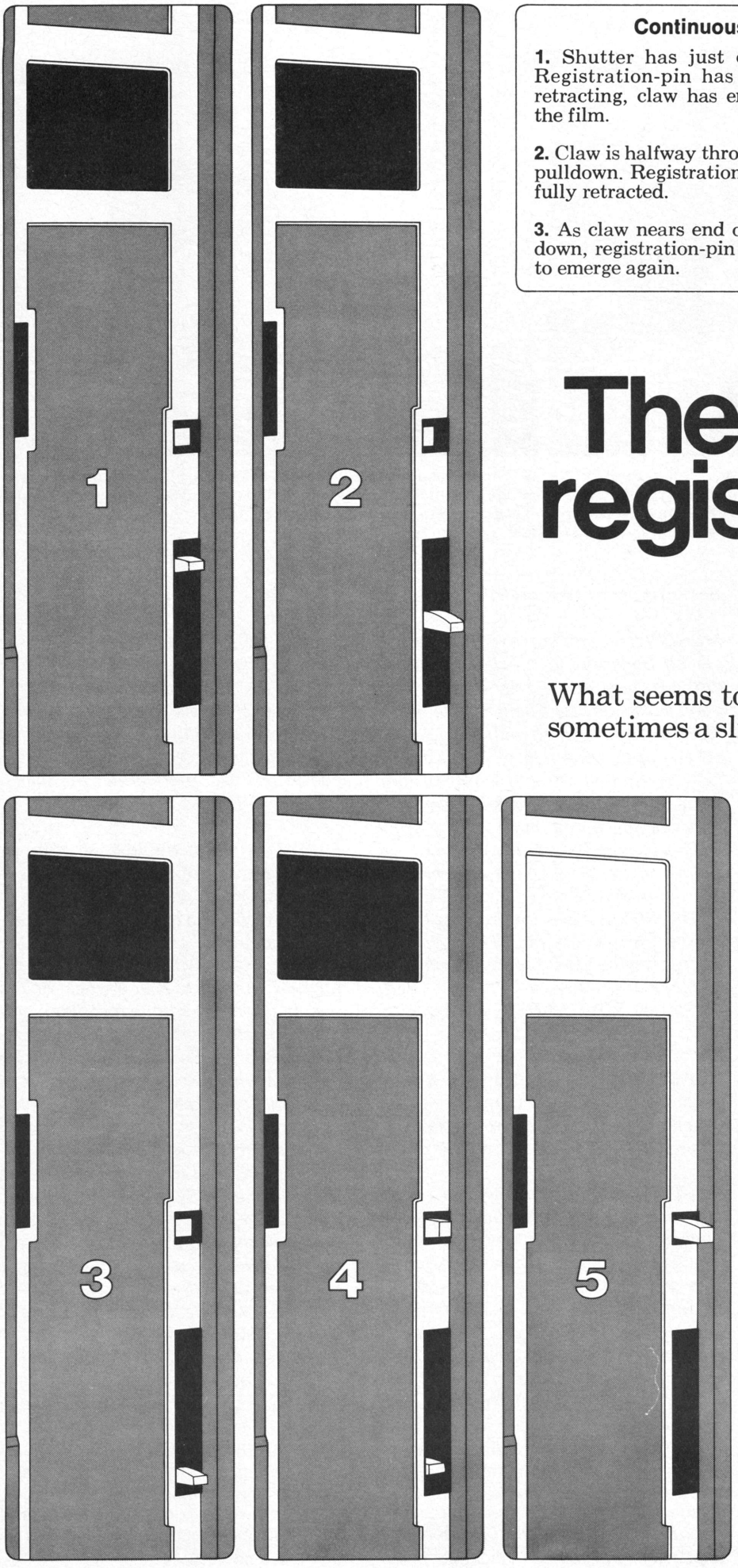


Continuous film control: five stages.

1. Shutter has just closed. Registration-pin has begun retracting, claw has engaged the film.

2. Claw is halfway through its pulldown. Registration-pin is fully retracted.

3. As claw nears end of pulldown, registration-pin begins to emerge again.

4. Claw begins retraction. Registration-pin protrudes to move the film to its final exposure position and hold it there.

5. No movement. Claw is fully retracted. Registration-pin is fully out and motionless. Shutter has now opened for exposure.

The 16SR registration pin:

What seems to be an unsharp lens is sometimes a slightly unsteady image.

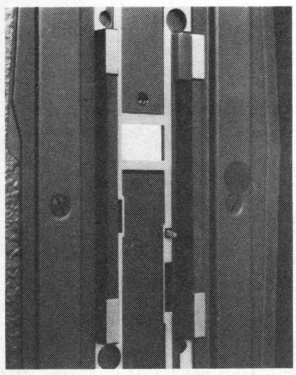
At 24 fps, a 30 minute film contains 43,200 photographs. Each of them should be exposed on film that isn't moving. In frames that are positioned *just so*, one after the other.

A registration-pin movement costs more to build and is harder to make silent. Why do we insist on one?

Of the moving parts in a 16SR movement, 40% have to do with the registration-pin. Clearly, we *must* think it important. And ARRI has been making cameras since 1917, so we've had time to think about it.

Between exposures, the claw must move the film a relatively large distance, fast. During exposure, the claw must hasten back up to do it again. The 16SR registration-

Technology of the 16SR/One of a Series:



Interaction tolerance: 0.0004 inch.

pin positions the film, slowly, and holds it there during the exposure, motionless.

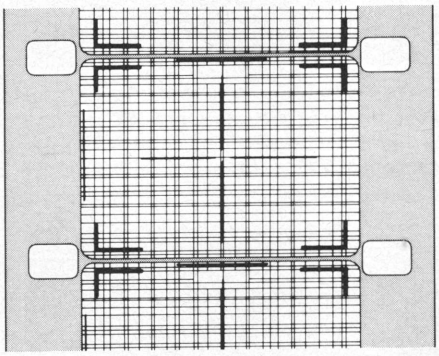
These are distinct functions. In the 16SR, therefore, claw and pin have independent control mechanisms. (Nevertheless, their interaction tolerance is 0.0004 inch.) The pin is shaped like an optical printer sprocket. And since it *moves* the film to its final exposure position, the relationship of the image to the sprocket-hole is *identical every time.*

The heart of the matter: Control at every step.

Either the claw or the pin is engaged in a film perforation *at all times.* At every stage of the pulldown, positioning and exposure cycle, the film is under positive control.

How sharp is that lens? It can depend on the camera.

Before image unsteadiness gets bad enough to be perceived as such, it can appear to be lack of sharpness. A registration-pin movement costs more money. So does a first-quality lens. They go together. It would be illogical to save money by matching an expensive lens with a pinless camera.

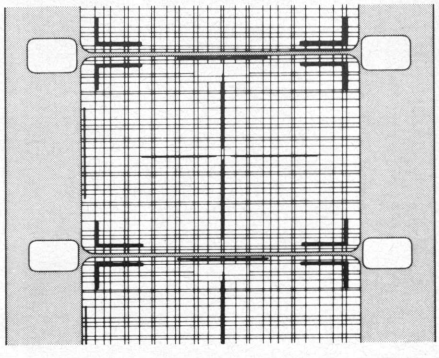


Double exposure steadiness test:

Each new 16SR is tested by running a length of film through it. As part of the test, we shoot a grid-pattern target. After the first exposure, we offset the target slightly, wind the film back and re-shoot (see illustration above).

When you buy a 16SR, you get the test film for that camera.

We project each camera's test footage. If film registration weren't perfect, the superimposed second grid image would be seen to move on the screen in relation to the first. *But it doesn't.* When you buy a 16SR, you get a small blue box containing that piece of test film.



Is it *always* necessary?

Movies have been made without a registration-pin, of course. But the pin can improve image quality from good to excellent. And it provides assurance that the camera will perform under adverse conditions and for a very long time.

No; just sometimes.

If you have to shoot in tropical or freezing weather, or in high humidity. If you're under extra G force loads (in a car or plane). If the camera is getting on in years, or hasn't been overhauled lately. If you have to super titles, or shoot at high speed. If the rawstock isn't fresh out of the refrigerator. *That's* when the registration-pin earns its keep.

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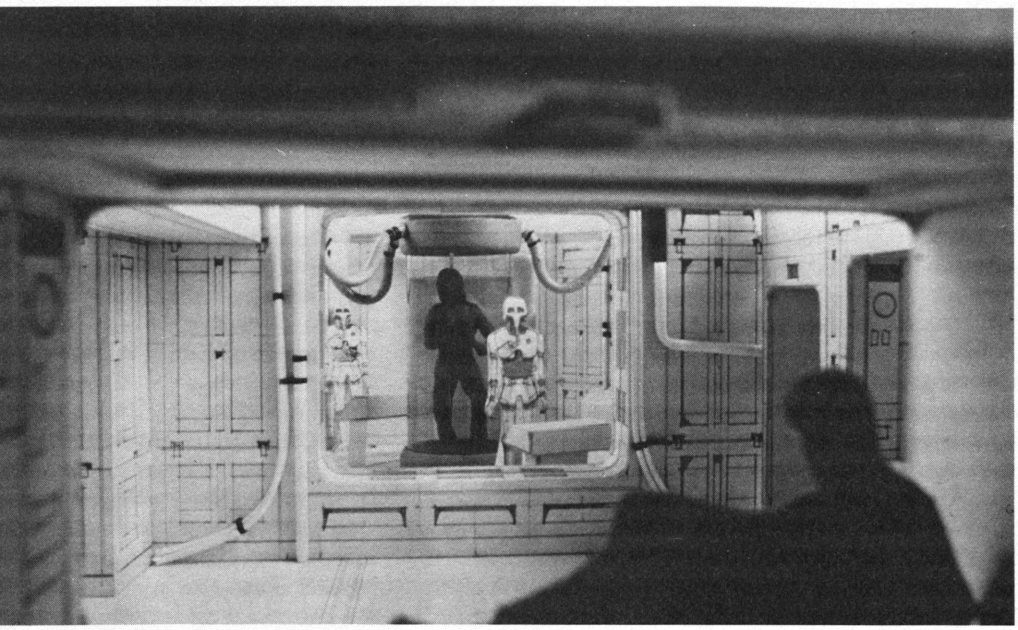
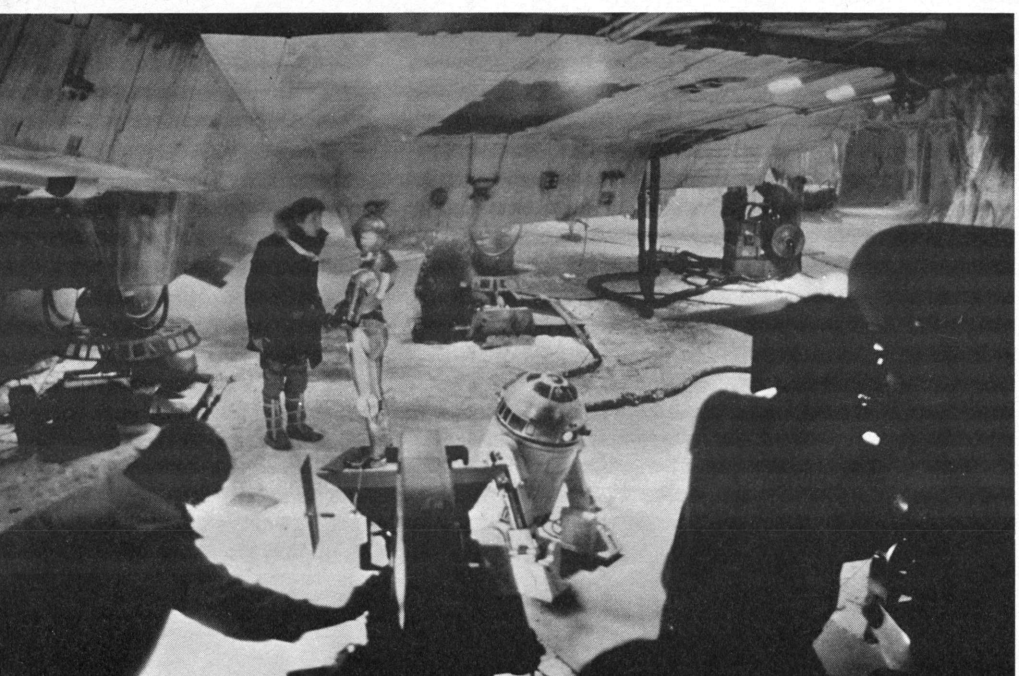
Director Irvin Kershner, Producer Gary Kurtz, Director of Photography Peter Suschitzky, remained close friends after six months of shooting and a year of preparation. Suschitzky was tagged for the assignment a year-and-a-half before actual filming began. EMPIRE marks his first excursion into the exotic world of science-fiction filming. (Photo: George Whitear.)



Miniature mock-up of a set in which Luke Skywalker is submerged in a column of liquid to heal his wounds. Suschitzky suspended a large mirror above the tube and lighted it from below with a searchlight, letting the rest of the set go dark. (Photo: Richard Blanchard.) (BELOW) The lovable robots, R2-D2 and C-3PO, before the camera. (Photo: Gary Kurtz.)



THE PHOTOGRAPHY OF "THE EMPIRE STRIKES BACK"
Continued from Page 550

cold—was not a very funny experience. It refused to get up to speed on several occasions. The film broke and we had all sorts of problems with it, but in the end, I'm sure that the results of the matte work being done on a large format are going to be worth all the extra trouble.

QUESTION: What did being involved with a production so long beforehand mean to you?

SUSCHITZKY: Being approached by George Lucas and Gary Kurtz a year-and-a-half before shooting began—even before they had settled on a director, in fact—didn't mean a constant involvement. It meant meetings now and then over that period, with a greater intensifying effect toward the end of the period. It meant getting excited about a really interesting film—or trying not to get excited about it, in case it didn't happen. I met Irvin Kershner, the director, about a year before we started shooting, I suppose, and we immediately struck up a good relationship. I feel that we have kept that up right throughout the production period—which, I must say, I feel very happy about. After about six months of shooting and a year-and-a-half of preparation, to come out the other side and feel that we are still friends is very pleasing. But to answer your question more specifically, it meant, toward the end of the period, visiting the studio, talking with the Art Director and looking at his plans, going away, thinking about them, coming back and throwing in ideas and asking them to do certain things. It meant the bending backwards and forwards of ideas and slowly having to plan how I would light the sets, because some of them were enormous.

QUESTION: Isn't it true that they built a stage specifically for this film—a permanent stage?

SUSCHITZKY: Yes, although, obviously, it will be used for other films in the future. Some of the sets needed a lot of thought, as they involved great expense in terms of man-hours and equipment rigging. I suppose it is fair to say that I am a slightly "untechnical" cameraman—more instinctive than technical—but obviously every cameraman has to know roughly what he is going to need in the way of equipment, because there is no use saying: "Well, I might need 100 Brutes or I might need only 50 Brutes." When it comes to those figures, a company is going to want to know if you really need

100, or 50 or if you can make do with two. So the really big sets needed a lot of thought. In fact, the small ones did too. Sometimes the small ones were more exciting to work on than the larger ones.

QUESTION: To what extent did you have to plan your work to accommodate special effects?

SUSCHITZKY: I have never been involved in a film with quite so many effects—and half-finished sets which will look finished when the matte work is done at the end. All of that needed very careful planning, because it was quite obvious that my lighting of a part of the set (the rest of which was to be matted in) would commit the matte artist to a certain way of painting his matte, and it required an act of imagination to try to picture in my mind what the thing was going to look like when he finished. In regard to that and the many other complex technical problems inherent in this production, I just want to mention that I was immediately impressed with the seriousness with which George Lucas and Gary Kurtz approached the project—to the point where I have to say that I've never worked with producers who had such thorough technical knowledge of the medium. They were very keen that we should get the best possible result on the screen. They said, "What do you want to test? Which cameras do you want to test?" So I had total freedom to bring in any anamorphic system I wanted—not that the choice is great. I was even approached by one man in this country who was trying to persuade me to use a three-dimensional system, but when I asked him whether it had been used before, he said that it had only been tested in Moscow. I thought it best to put that out of mind for a few years.

QUESTION: When you were doing comparative tests you chose to do your special effects photography in VistaVision. Why was this—and why VistaVision in preference to 65mm?

SUSCHITZKY: I can only answer that by saying that it wasn't my decision. That had already been made. They had, I believe, used the VistaVision system on STAR WARS.

QUESTION: Did you use VistaVision only for plates or did you use it for anything else?

SUSCHITZKY: The VistaVision camera was indeed used for plates—but it was also used for live action material which would later on be combined with

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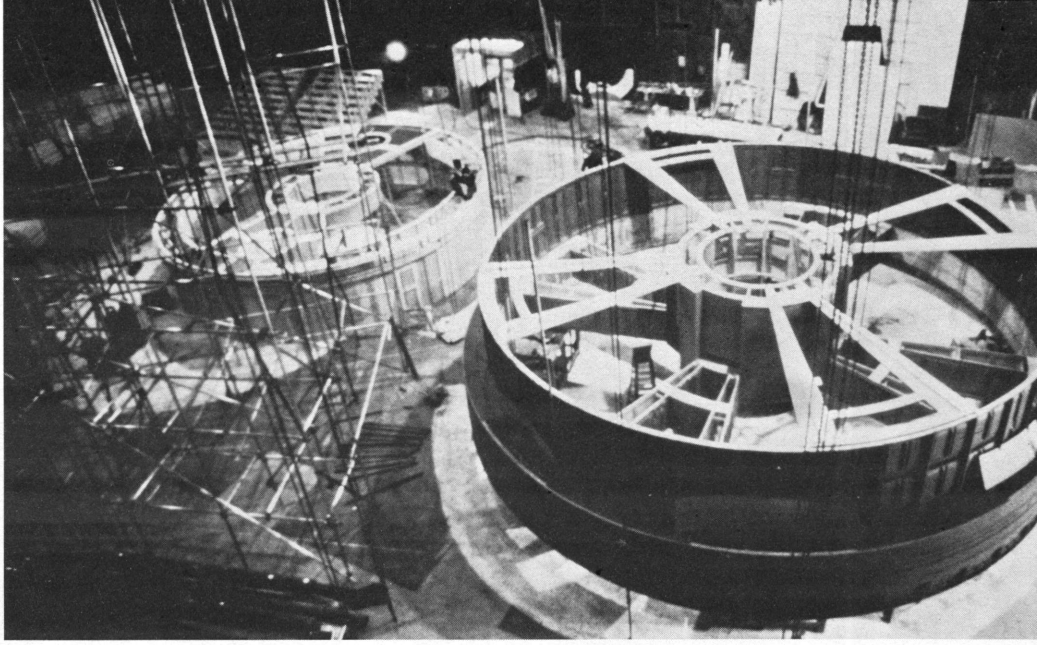
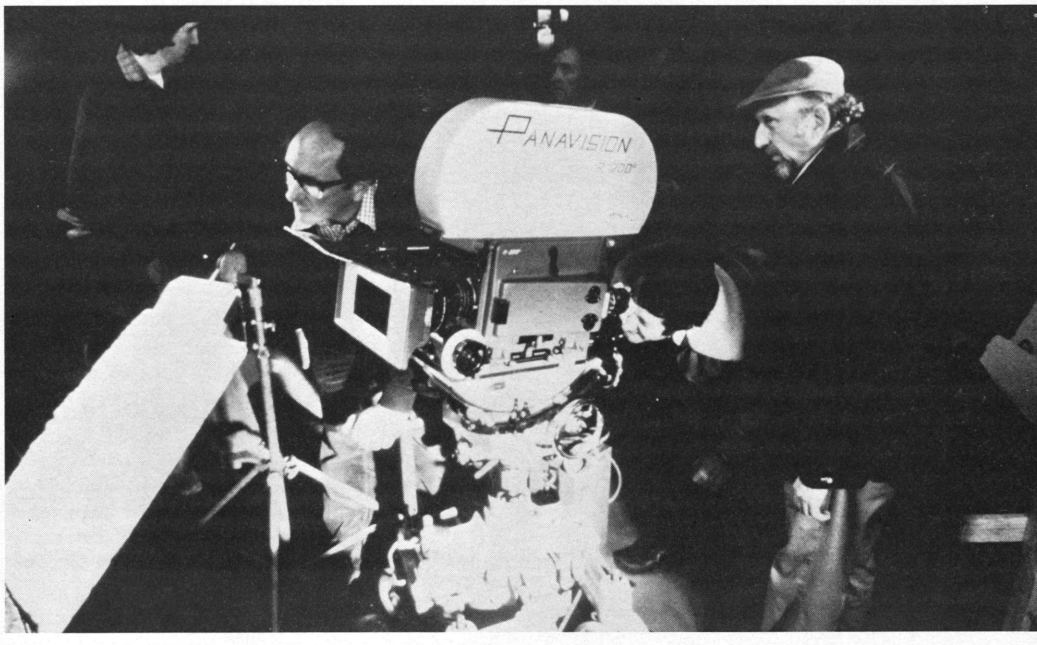
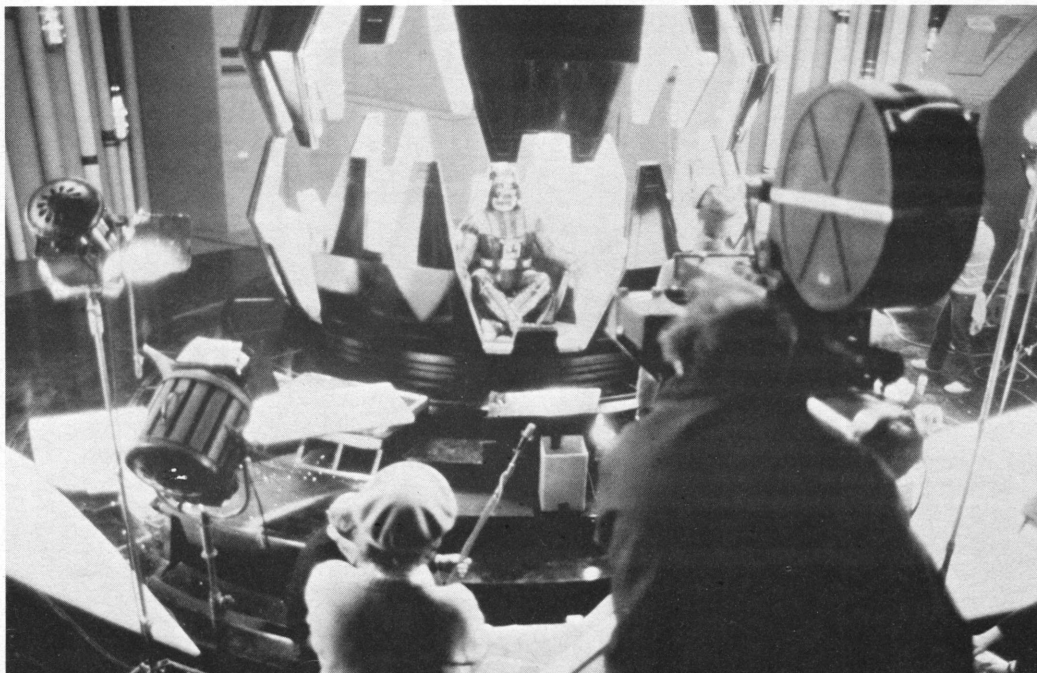


Huge sets under construction on Elstree sound stage. THE EMPIRE STRIKES BACK was made on two levels—at the studio in Elstree and at Industrial Light and Magic in California. Lucas and Kurtz had the responsibility of keeping these two dimensions accurately interlinked. It worked out well, considering the 6,000-mile gap in distance. (Photo: Douglas Dawson.)



Suschitzky lines up a shot using the Panavision R-200 camera. Also used were the Panaflex, the Panaflex-X and the Pan-Arri. (Photo: George Whitear.) (BELOW) The VistaVision camera, an 8-perf-per-frame, horizontal-pull camera, was used for filming plates and live action scenes that would later be combined with plates. (Photo: Gary Kurtz.)



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CREATING THE MATTE PAINTINGS FOR STAR WARS THE EMPIRE STRIKES BACK

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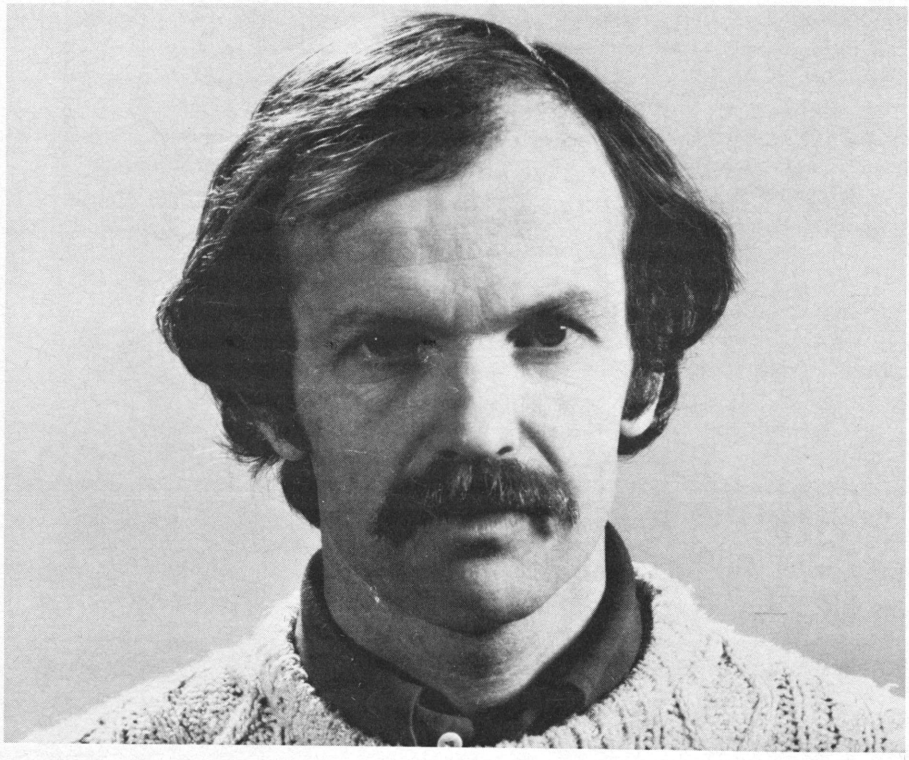
By HARRISON ELLENSHAW
Matte Painting Supervisor

I was enthusiastic about working on THE EMPIRE STRIKES BACK because I had worked on STAR WARS and it was a very enjoyable experience working with Gary Kurtz and especially George Lucas, for whom I have a great deal of admiration and whom I like as a person.

I was unable to join the picture until the post-production phase, when all of the first unit photography had been completed, so I came in with approximately six months left. I was presented with the live action plates as they had been shot and given the job of creating the matte shots to go with those plates. We ended up by having approximately 50 matte paintings in the show.

Initially the problem was that a lot of the equipment we had counted on using had not been completed. We had intended to use front-projection fairly extensively, but the equipment was not finished when I came. In fact, the lamphouse was still being built. Things like that are always a bit worrisome, because you know you are going to have to do a little research and development while you are trying to get the picture done. But we were fortunate; we put in a lot of long hours and had a lot of helpful people and I think we got the job done on a satisfactory level.

Matte Painting Supervisor Harrison Ellenshaw, son of famed Matte Artist/Production Designer Peter Ellenshaw, proudly carries on the family tradition, most recently with his work on THE BLACK HOLE and now on THE EMPIRE STRIKES BACK. On the latter, about half of the paintings were executed by Conceptual Artist Ralph McQuarrie.



My initial worry was that there were a number of plates that had been shot in England and, for one reason or another, weren't as they should be. We had a number of plates that were out of focus; we had a number of plates that had some degree of camera movement in them, a little jiggle. We thought, "Gee, if these plates have such things wrong with them, what other problems might we have that we don't know about yet?" So we just kind of took it a day at a time.

We were on a very tight schedule, which is always the case. You can never have long enough, but that's the nature of the business. We put our faith in the front-projection unit, feeling that it would be the right way to go. As it turned out, we used front-projection; we used some rear-projection; we used bi-pack, and we also shot matte paintings onto VistaVision as VistaVision elements to be composited optically on the optical printer. So we used quite a number of methods to get the job done and that was because we found, as we got into each shot, that certain advantages from each method would apply to that shot better than other methods and give us the best possible result. Each method has its disadvantages, certainly, but you can minimize those if you are not worried about that particular disadvantage on that particular shot.

On the several methods that we used (front-projection, rear-projection and bi-pack), we still ended up by using both low-contrast plates and separation masters, depending upon the subject matter. If we wanted to have the contrast slightly increased, as perhaps in the case of a shot that was a little soft, we could pump the contrast and give it a little sharpness. Where we were very concerned about grain, very concerned about reproduction quality, then we would use separations. Generally, that's kind of the way it broke down.

Toward the end of our work on the film it got a little tense. You don't want to switch horses in midstream too often, because every time you do it sets you back a week or two, while you kind of bring along the new method and do tests and hope to get rid of the gremlins and the glitches. So it becomes a little tricky as the weeks start compressing on you and you begin counting the days. There is a lot of finger-crossing and a lot of hoping that you can stick with a method that is going to pan out. Eventually, if it's not panning out, you've got to make a decision pretty quickly to go to another

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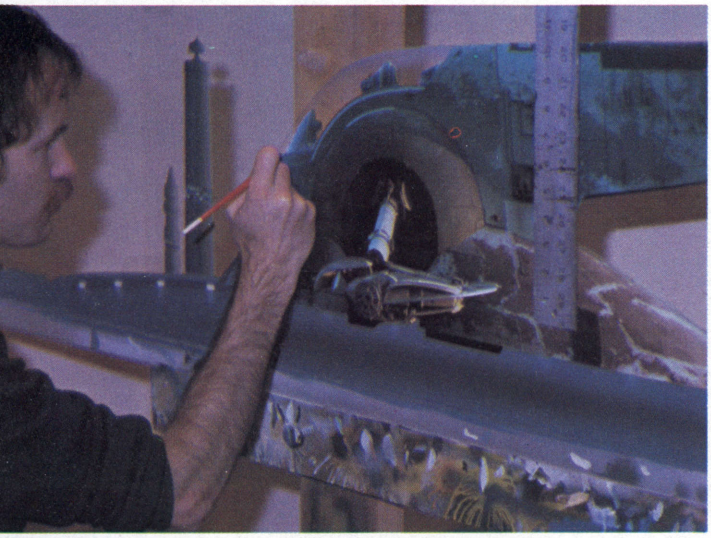
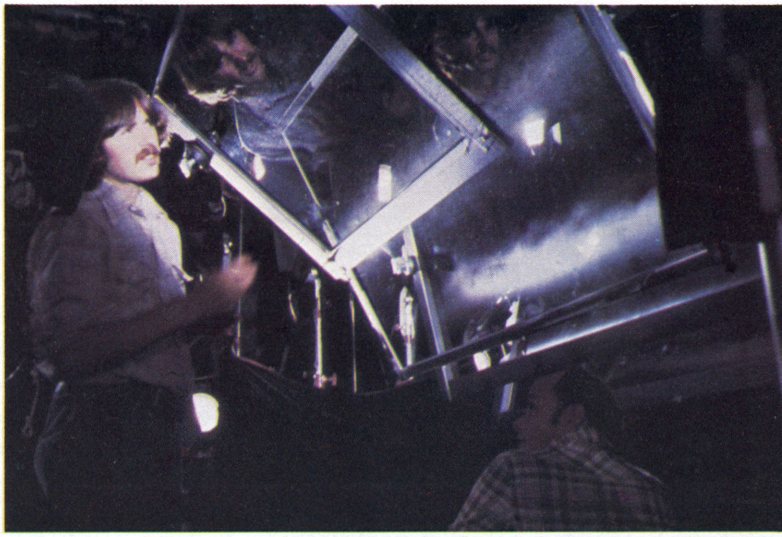
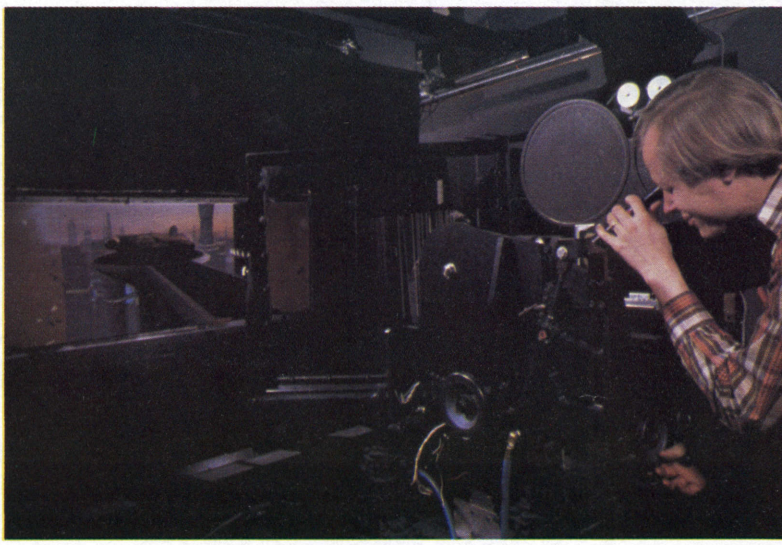




(LEFT) Harrison Ellenshaw, Matte Painting Supervisor, painting Boba Fett's ship on Cloud City landing platform. (Photo: Terry Chostner.) (RIGHT) Mike Pangrazio, matte artist, working on multi-planed asteroid painting. (Photo: Howard Stein.) (BELOW LEFT) Ralph McQuarrie painting Cloud City with Millennium Falcon projected onto glass. (Photo: Nancy Moran.) (RIGHT) Neil Krepala, matte cameraman, shooting McQuarrie's Cloud City painting. (Photo: Nancy Moran.)



A ponderous Snow Walker on the Ice Planet Hoth is attacked by a fighter craft. This is not a matte painting, but rather one of the highly detailed production design storyboard renderings painted by Conceptual Artist Ralph McQuarrie, who also "doubled in brass" by painting about half of the matte paintings used in THE EMPIRE STRIKES BACK. This proved to be a great aid to Harrison Ellenshaw, who came onto the project after principal photography was completed.

method and it gets rather interesting. We shipped our last shot on the very last day, literally. We shot it on a weekend and knew that whatever we shot would have to go into the picture. Luckily, it was a good shot. It was a very simple one, as a matter of fact, but you never know which ones are going to be tough.

There were many times more matte paintings in EMPIRE than there were in STAR WARS, and I was fortunate to have the help of Ralph McQuarrie to do probably about half of the mattes. That was a tremendous help to me because there was an enormous amount of work piled up when I got there. We started painting immediately, just digging into the pile and doing paintings. I was still greatly concerned with the mechanics of the situation and seeing that the equipment was coming along the way it should—making the right tests and pushing that along, as well as getting the paintings done. So it was great to have Ralph, who is a tremendous artist and was also the Conceptual Artist on the film, just to be there and do paintings at the same time. That saved me.

There are, of course, a number of sequences throughout the film where matte paintings are used and they are all quite different in terms of locale. One is in the snow, one is the Cloud City, one is an interior, one is on the Bog Planet. We had mattes scattered throughout.

Darth Vader traps Luke Skywalker during their climactic lightsaber duel. Many matte paintings were used in this sequence, some with rear-projected elements for blue screen. The rear-projected elements had to be projected with motion-control, and the moves had to be matched on the paintings.

There is one major sequence in which many matte paintings are used. It takes place at the end of the film, when Darth Vader and Luke are having a laser sword fight inside a giant tube that kind of runs away to nothing. They are on a catwalk above it, inside Cloud City and, at one point, Luke falls and we follow him down the shaft. That's a painting with a rear-projected element for blue screen. In

Continued on Page 607

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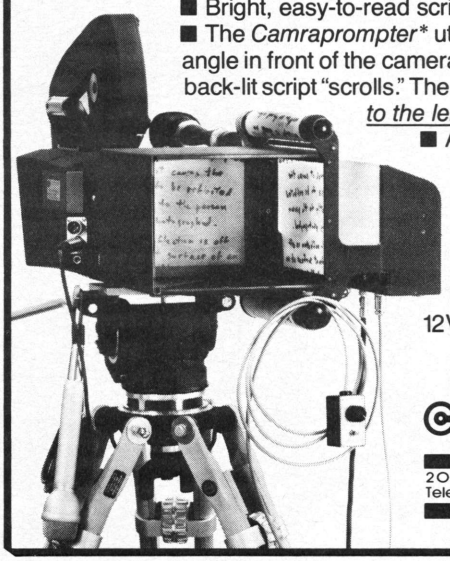

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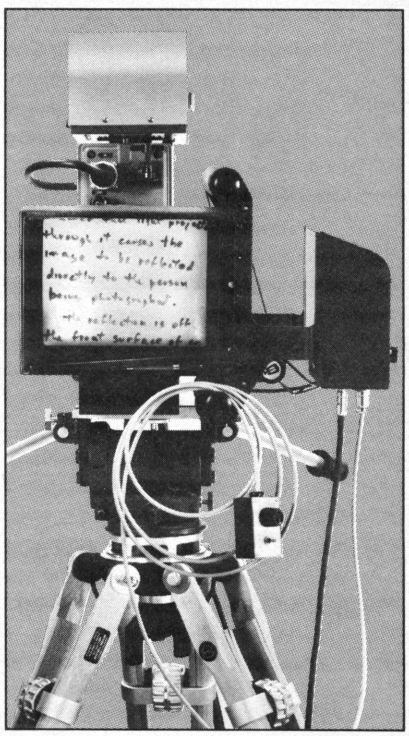

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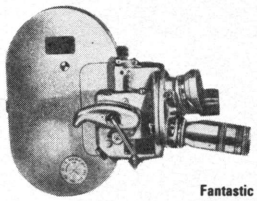

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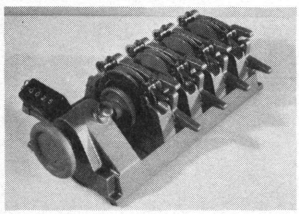

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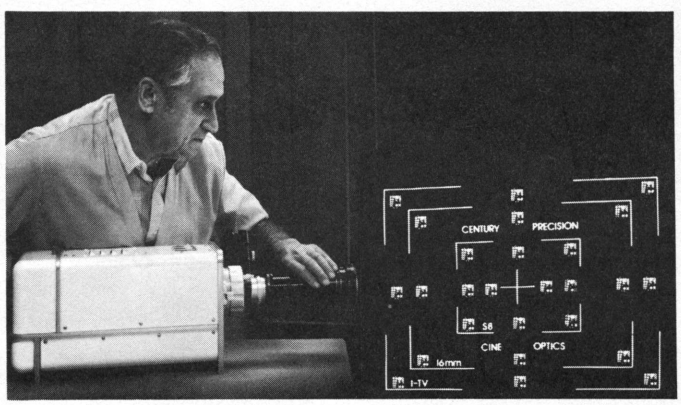

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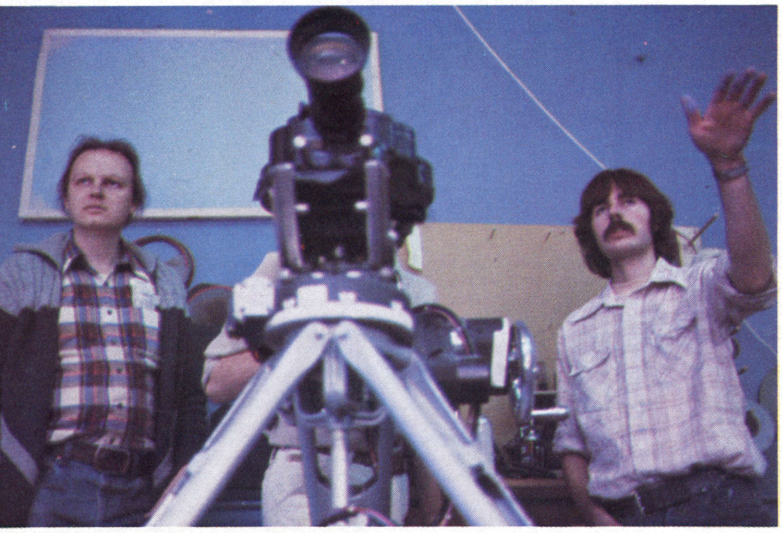
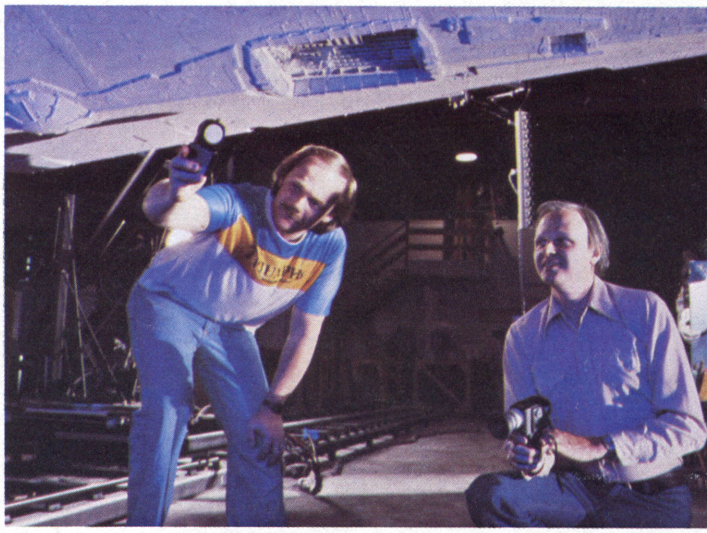
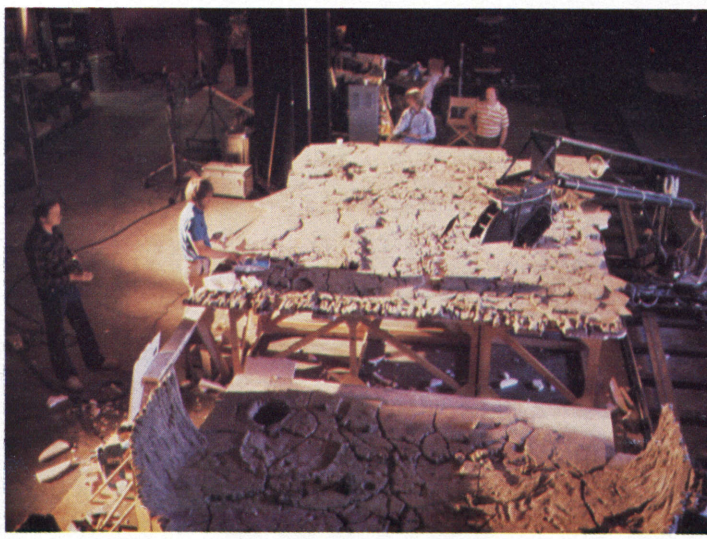


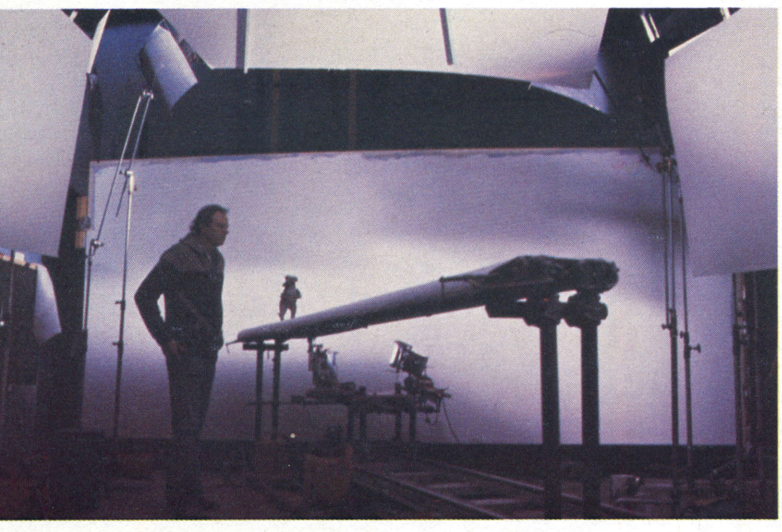


(LEFT) Dennis Muren discusses the set-up of a shot with matte artist Mike Pangrazio. (Photo: Terry Chostner.) (RIGHT) Muren and Cameraman Don Dow lighting an eight-foot Stardestroyer. Special challenges of the effects photography included making tiny models look very big and making indoor light look convincingly like outdoor light. (Photo: Howard Stein.)



(LEFT) Clint Palmer (Assistant Cameraman) and Jim Veilleux (Cameraman) program shot of an oversized section of Vader's Stardestroyer. This model is a section that represents the first inch of the full-size Vader ship model. (RIGHT) Crew working on flex shot of asteroid crater. (Photo: Howard Stein.)

(LEFT) Dennis Muren setting up miniature Tauntaun stop-motion animated shot. (Photo: Terry Chostner.) (RIGHT) Muren supervising chase scene in an asteroid chasm. (Photo: Howard Stein.) Whereas only the chess sequence in STAR WARS involved stop-motion, several key sequences in EMPIRE called for implementation of this painstaking technique.



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himself when he feels like it. Phil and Jon put a lot of time in on this, staying late hours and learning a lot about animation. They had been doing stop-motion for ten years, but what they learned in just a few months on this piece of equipment was pretty incredible. It relieved a lot of anxieties. They weren't so concerned about how it was going to look, because they'd had time to practice and sort of knew how it was going to look. It was a different climate of working, in which the fear was taken out of it. Shooting it for a movie camera was not all that different from shooting it for an electronic camera, which they'd done many times before. So I highly recommend that approach to stop-motion animation.

QUESTION: Aside from the problems you've already mentioned, what are the specific difficulties encountered in the actual photography of stop-motion scenes?

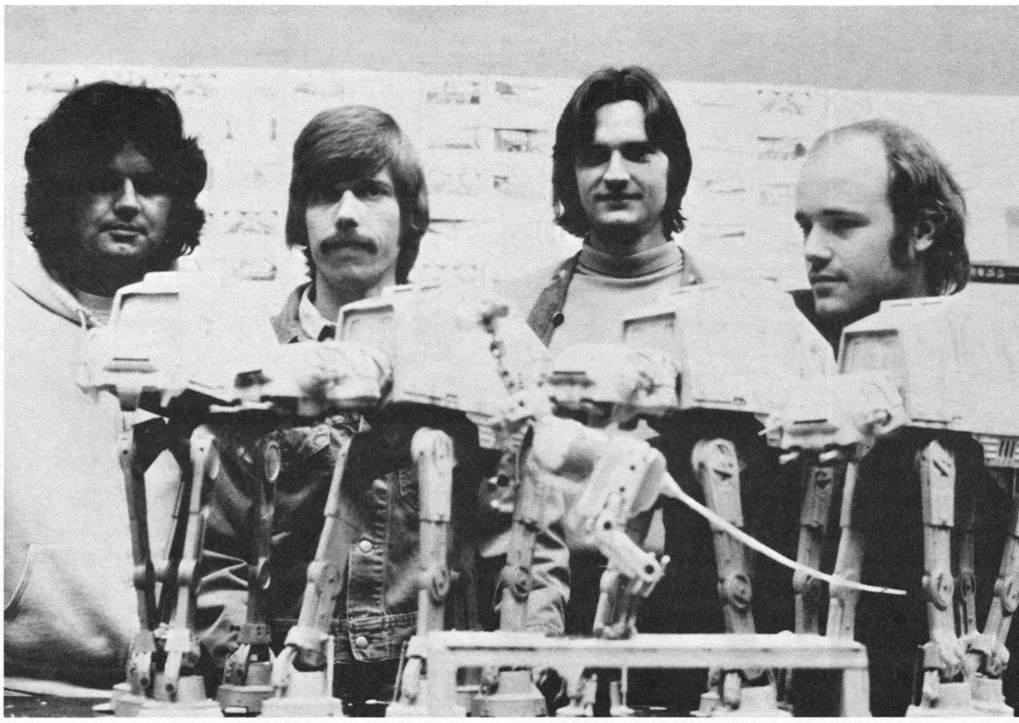
MUREN: I wouldn't say that the photography of stop-motion is much more difficult that photographing miniatures. Miniatures in general are difficult, primarily because you usually don't have room to put up the lights that might be necessary to do the work. You are often focused on a very small set in a very cramped area.

QUESTION: But what about the problems of lighting a tiny set or object to make it look full-size and real?

MUREN: That's a major challenge and the Walker sequence in EMPIRE forced me to come to terms with a problem that we have been trying to solve for years and years—namely, that of making indoor photography in color look like outdoor photography. When I was doing commercials at Cascade I used to experiment with various solutions to the problem. On this show I sort of narrowed it down and decided that the solution depended on the color of fill light and the size of the fill light units you used. We use pretty much of a bounce card situation and the key light has to be a very small source in order to get spectral highlights off the models. If you put all these things together you can get stuff that looks pretty much like outdoors. We're quite happy with what we've been getting.

QUESTION: Do you use a basically colder fill?

MUREN: Oh, yes. You simply go outside and look at what is really there. You use a cool fill, but it's got to be pretty close to a specific color; it's not just any cool thing. It has to match with the background. The way it worked on EMPIRE was that I would pick a 4 x 5 background transparency out of those they had shot for reference in Norway. Then Mike and Ralph would paint up backgrounds based on the transparency. We would then paint the bounce cards to match the right color of fill light and set the key. During all that time there was a lot of analyzing going on, plus checking of the background paintings, because the color had to be real accurate. There was a problem with the transparencies when they were processed. Everything had a kind of greenish cast. So we had to shift all that back to a more normal environment and try to get the backgrounds to look normal. The object was to shoot the scene in such a way that you wouldn't have to make any color corrections later. When you looked through the camera, what you saw would be the way it really looked out there.



Key members of the Stop-Motion department standing behind four Snow Walkers, with Tauntaun armature in foreground. Left to right: Tom St. Amand, Doug Beswick, Jon Berg and Phil Tippett. Totally realistic, their battle on the Ice Planet is a triumph of the enormously demanding art of stop-motion animation.

QUESTION: From the mechanical standpoint, how was that achieved?

MUREN: It meant that you had to go in with extra lights to pump up certain areas, in order to get more information on the negative than actually was painted. I found that this helped an awful lot toward creating the illusion of reality. It made the areas that were supposed to be white whiter than white. That's the way it really is outdoors. You have a tremendous latitude outdoors, which your eyes are always adjusting for.

QUESTION: On these corrections that you had to make, did you filter the camera lens or the lights or both?

MUREN: The key light always remained normal and all the corrections would be made with the fill light—the color of the fill card, actually. The lenses were constantly diffused with selective diffusion just in certain areas. In the Walker sequence that depended on how far the different Walkers were spaced within the shot and just what was needed to give a really nice look to the shot. I was trying for a lot of "distance" and a nice dramatic impact, something that would be very memorable to people and would make them say: "That looks really neat!" or "How did they do that?"

QUESTION: What do you find creates the best illusion of distance in a miniature set?

MUREN: Well, a wide-angle lens can sort of give you the illusion of distance, but this technique has been overused, in my opinion. The real way to do it is with the lighting. The whites go darker and the blacks go lighter toward the blue and everything just sort of hazes out into a mush. You can walk outside and look at

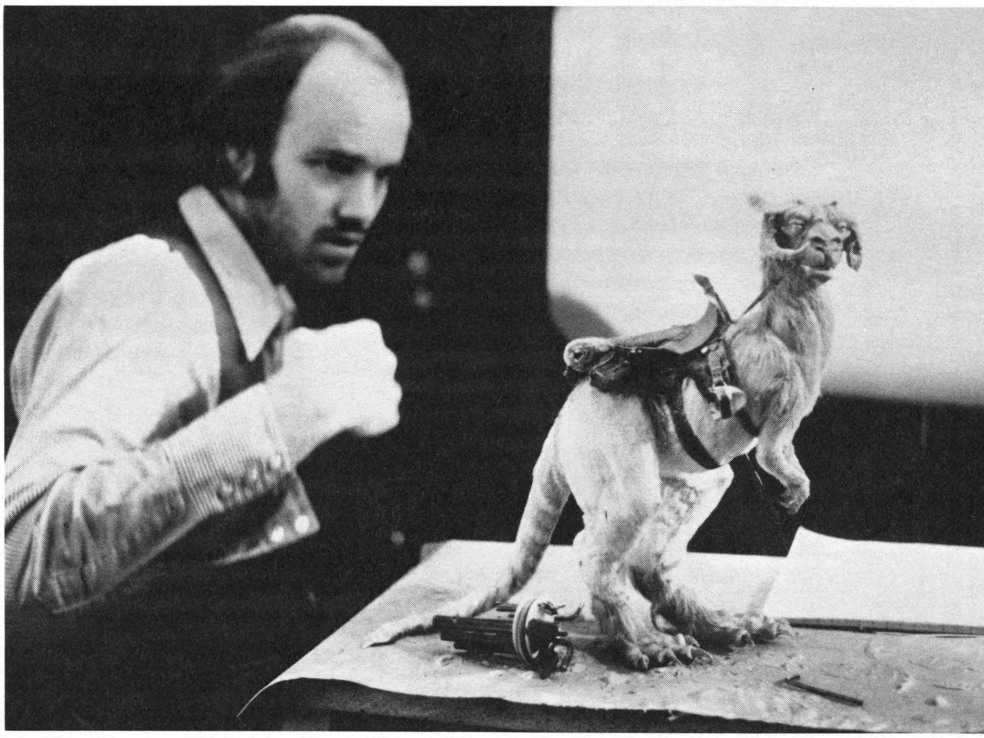
mountains as they recede into the distance and you can see that effect happening. It's a matter of paying attention and realizing that it is necessary. Anytime you put something in the background, there is an aerial haze that has to be in there—which you usually can't get in a 15-foot space on a shooting stage. So even if it is a blue screen composite, where you are shooting an element that has to go into a real outdoor landscape—and it's duplicating something that is, in fact, 150 feet away in the snow, but it's only 10 feet away on the stage—you've got to diffuse it. You've got to get rid of the blacks; you've got to try to knock the whites down and sort of mush everything together, and there is a real resistance to that at first, because you don't want to destroy the image too much and everyone's going for the sharpness and all that sort of thing. But once a composite comes out with that done to it, the realism is strikingly apparent and you say: "Wow! That's the right thing."

QUESTION: To get that desired "mushed out" effect, do you use filters in front of the lens or soften the light?

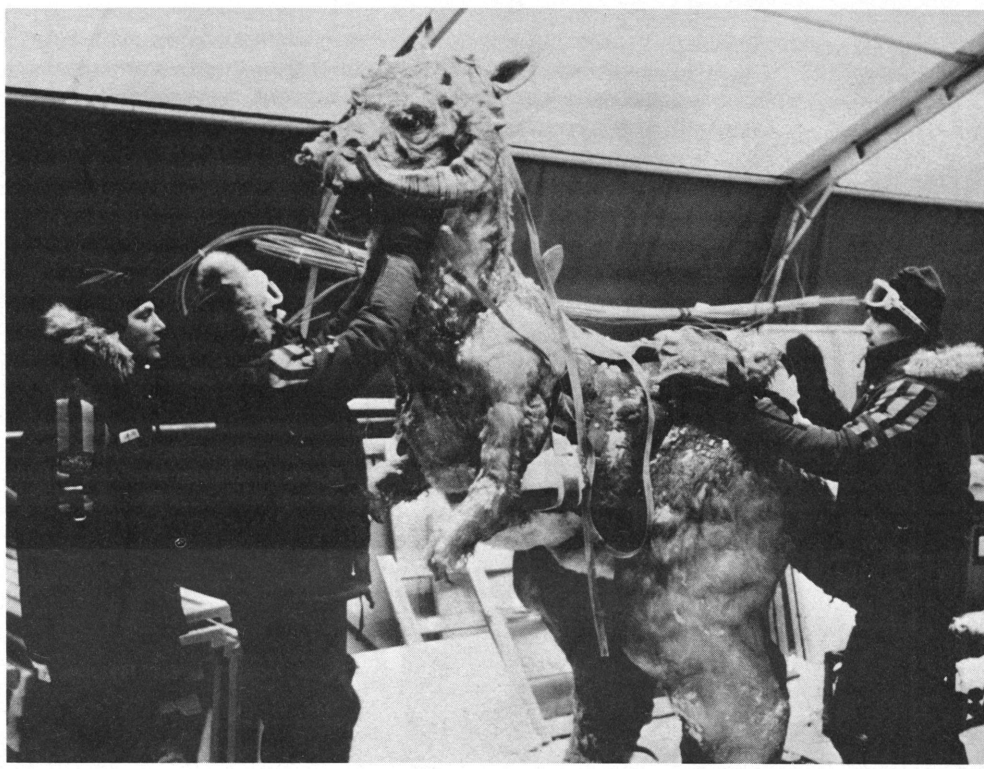
MUREN: I do both. I soften the light and I put filters in front of the lens—except for blue screen. The blue screen stuff we are shooting as crisp as we can. We are softening the edges slightly in focus on a couple of the shots, but mainly we are shooting it crisp in order to get the best blue screen material on the negative that we can get. We are using the best lenses we can get, at the best f-stops we can get. Then Bruce Nicholson is adding the diffusion on the optical printer. That's our procedure for the blue screen shots. For the other shots I am just making up my own diffusion, but shooting everything with a #1 Harrison & Harrison filter, and then going on top of that with special dulling spray on glass in certain places. A lot of time is going into the look of each shot, because it doesn't matter what it took to get it or what went on behind the camera. It just matters what's left on the screen.

QUESTION: Do you have any comment to make on the models that were used in the stop-motion animation sequences?

MUREN: They're all beautifully designed characters. Joe Johnston and Ralph McQuarrie designed the Walkers, and Phil Tibbett the Tauntauns. The armatures which held the puppets in position were built by Tom St. Amand here at ILM. If you want to move a puppet, it goes right where you want it to. One of the problems up until now has been that the armatures have been rushed through. It was recognized on this project that we had to have really good armatures and Jon took the time and care to design them well. Once again it comes down to what is on the screen. It doesn't matter what the excuses are. They may be understandable to us, but to the public they aren't understandable.



Phil Tippett, Stop-motion Animator, studying miniature Tauntaun for next movement. The mythical Ice Planet creature, with its loping gait, moves most realistically on the screen. (Photo: Howard Stein.) (BELOW) On Norwegian location, technicians ready full-size mechanized Tauntaun for a lope across the frozen wastes.



QUESTION: Can you tell me if there is anything unusual about your handling of the blue screen photography on this project?

MUREN: On the photographic end we've been paying a lot of attention to anything that could go wrong. We don't have a lot of spill light hitting the screen,

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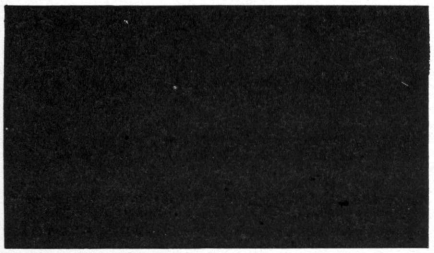

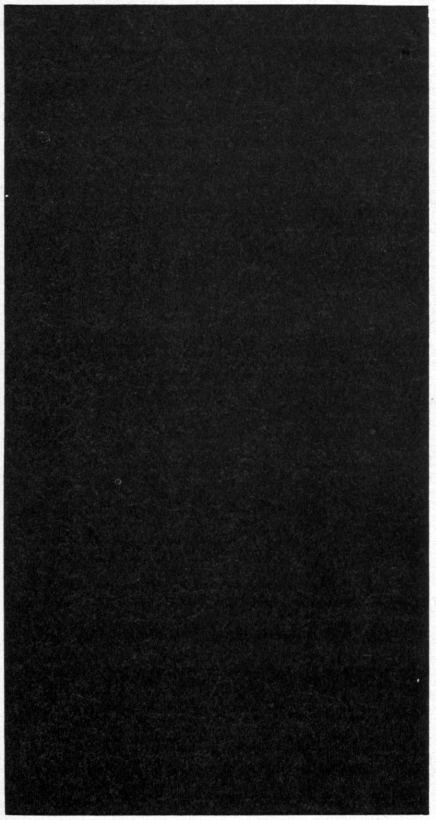

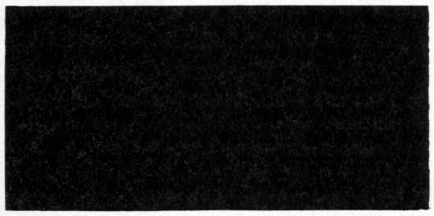

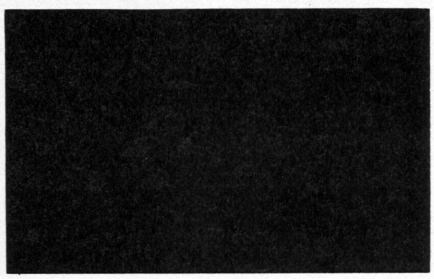

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but we've found out, quite surprisingly, that you can have a lot more spill light hitting the screen than most people think. Because of going with all the soft light that I feel you have to go with for the blue screen Walkers and Tauntauns and even some of the asteroids, we can fog the screen a lot and still keep the level below the threshold of the negative picking it up. So we are finding the widest tolerances we can to shoot blue screen. In other words, we are not being too cautious to the point where it's not doing us any good.

QUESTION: In other words, beyond a certain point you don't have to be absolutely meticulous in holding the light off the screen—right?

MUREN: Right. You don't need to anymore because it's still not showing up on the negative. It shows to your eye and you say, "Oh, my gosh—we're fogging the screen!" But it's not picking up on the negative and what you are getting is a much better looking lighting effect and a more realistic fill light situation because of all the bounce cards that are being used. Attention to detail is what makes the difference. We have some really nice blue, narrow band frequency blue screen fluorescent tubes that we're using that are giving Bruce a real good blue, with very little red or green.

QUESTION: For your high-speed work you must have to use a tremendous amount of light behind your translucent blue screen, isn't that so?

MUREN: Yes, Richard Edlund is shooting all the high-speed shots. I think he gets something like an f/8 reading at 96 fps. On the other hand, when we're shooting stop-motion at f/16 and one-second-per-frame, we've got a lot of ND in the screen most of the time, both for the work I'm doing and the motion-control work, but we can pull the ND out when we're shooting high-speed.

QUESTION: Is there anything out of the ordinary about the high-speed work that you're doing?

MUREN: I don't know whether it's out of the ordinary, but we're using a lot of smoke in front of the blue screen. We have Speeders that are blowing up and exploding as they fly by the blue screen camera, and we're going to have to pull some very nice looking mattes off of that, but we have the density control in the Optical Department so that we can make our separations and retain a lot of the smoke. But other than that, our blue screen work is similar to a lot of the work that has been done before. There are a lot of timing problems with the high-speed Walkers in the scenes where they are collapsing. A Walker is standing upright one moment and then it begins to collapse, and eight or nine different things have to happen in a very short time, including explosions and the tripping of mechanisms within the Walkers themselves so that they will fall down.

QUESTION: What were your matching problems in relation to the live-action photography?

MUREN: It went pretty easily, because there aren't that many scenes where the two relate. In some cases we dictated what the lighting situation was to Peter Suschitzky. In the asteroid sequence, for example, which was our first sequence, we started shooting our part of it long before he started shooting his. So I said to him, "In that sequence, it will look best if the key light, as you are approaching the asteroids, is lighting them from the left." Fine—no problem with him. He just needed that information. I studied his footage in the Walker sequence a lot in order to see what degree of greys there

Continued overleaf

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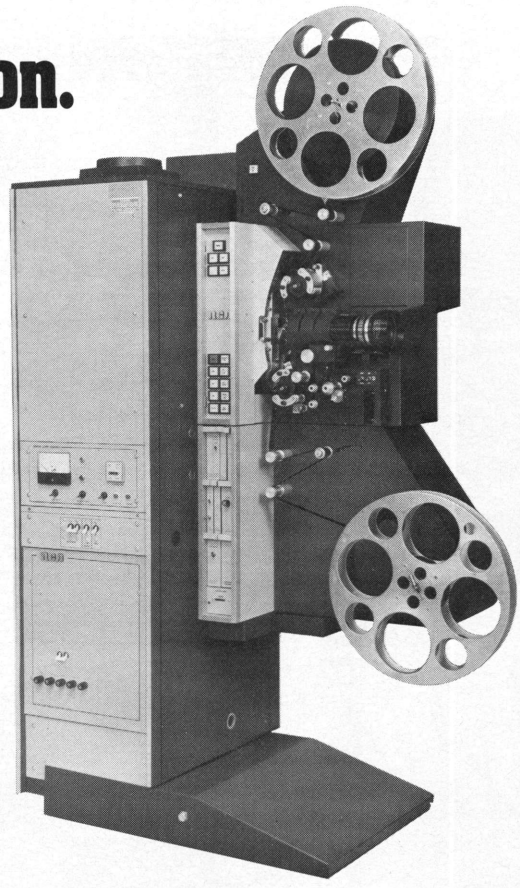

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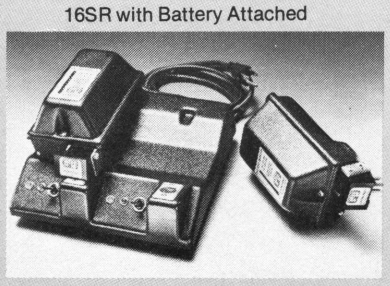

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were, to see what filters he was using. I already knew what they were, but I wanted to see the effect. We found that there was a certain lack of blacks and we tried to duplicate that for cutting purposes, so that everything would look like it was shot at the same time.

QUESTION: Aside from the Ice Planet, does much of the action take place on any other planets?

MUREN: There's a planet that has Cloud City on it. Most of that was done with matte paintings by Harrison Ellenshaw and Ralph McQuarrie. The Cloud City sequence has the Millennium Falcon, the X-wings and the TIE fighters flying through beautiful, romantic sunset-type clouds to this giant city that is floating in the sky, and that's where the film wraps up. Now, on STAR WARS the blue screen situations that we'd had to contend with had involved spaceships against a black background. If there were any black matte lines they didn't show up as much. But here in Cloud City we were dealing with real backgrounds shot (by Brian Johnson) from an airplane. So we had light-colored backgrounds with a lot of blue screen—the same problem they had in SUPERMAN, and this factor multiplied the difficulties ten-fold. The audience is expecting the same high degree of realism they saw in STAR WARS and, in order to achieve that, we've gone heavily into diffusion on the spaceships. We've knocked the blacks out of them; we've degraded the image, because the snorkle lens that the background scenes were shot with provided a less sharp image. We've done everything possible to tie all of these elements together so that the result will look real.

QUESTION: From your standpoint, what has been the most difficult aspect of the EMPIRE project?

MUREN: The main difficulty was the fact that we had to move up to Marin County and set up a whole new facility before we could begin. We started shooting last February and began a double shift on the main camera, with Ken Ralston shooting at night and myself shooting during the day. This went on for about five months. Then I had to break away from shooting and Don Dow started shooting in the daytime. Jim Veilleux has been shooting during the whole time, also. So we've had all the cameras in the building shooting for months and months and still the end is going to be a tight squeeze. I was hoping that by jumping the gun a bit we would be able to avoid the rush that always comes at the end of

Continued on Page 613

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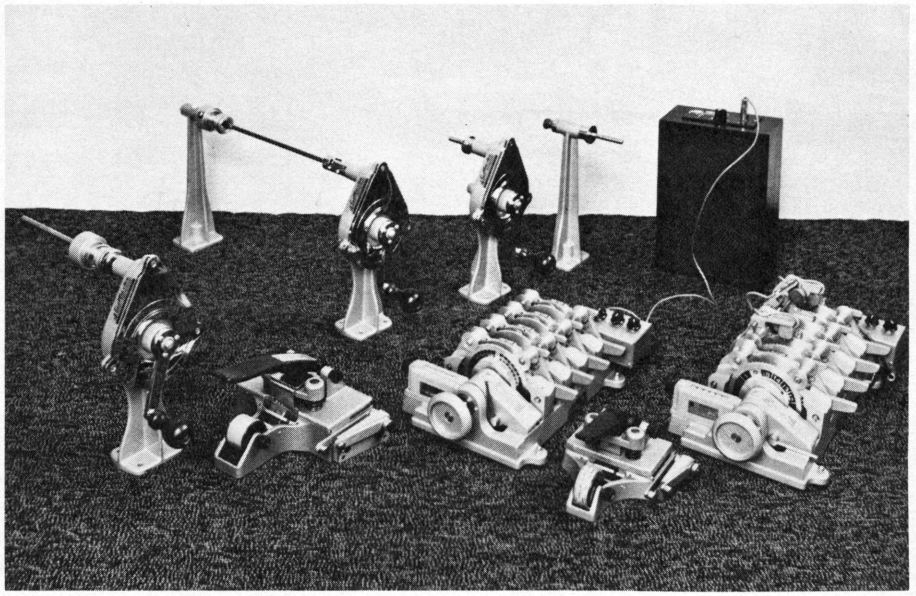

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FILMING THE AERIALS FOR STAR WARS THE EMPIRE STRIKES BACK

Aerial plates for this picture had to be consistent in quality with plates shot from a tripod-mounted ground camera to avoid quality-gap

By RONALD C. GOODMAN
Wesscam Cinematographer

Special effect or "process" photography has taken giant steps forward during these last few years as the science-fiction genre has returned to the screens. STAR WARS represented a quantum leap in visual quality and, therefore, we were especially excited to be asked to film the aerials for the sequel, THE EMPIRE STRIKES BACK.

Helicopter cinematography has traditionally become synonymous with vibration, movement and generally "compromised" quality in visual images. These deficiencies are especially noticeable when used as a background plate with a steady reference in the foreground, such as titles or studio-shot scenes inside the cockpit of a mock-up aircraft or spacecraft. Aerial plates on a picture such as THE EMPIRE STRIKES BACK must be commensurate in quality with plates shot from a camera on a tripod on the ground or a "quality gap" will be evident. It is therefore absolutely essential that the most stable and controllable camera mounting be used.

The Aerospatiale Lama 315B was the helicopter selected to film Wesscam aerial shots for THE EMPIRE STRIKES BACK. The shooting was done near Finse, Norway, a small village of 75 inhabitants nestled below a circular glacier five miles in diameter, 300 km WNW of Oslo.

We had been involved for more than nine years with the Wesscam mount in Europe. When properly set up, this remotely controlled, gyro-stabilized system is capable of stabilizing an entire camera, magazine, lens and all, to within .5 milliradian (about .045 degree) in both elevation and azimuth (pan and tilt) under just about all helicopter maneuvers encountered in aerial filming and still provide precise control. (Its limits: 360 degrees continuous pan, +30 to –90 degrees tilt).

This stability immediately opens the door on a possibility that makes camera operators of "conventional" aerial camera mounts groan. Namely, camera speed "undercranking" in order to accelerate screen speeds. This practice will seemingly exaggerate any vibration and movement of the image, if they are present, so, generally, operators like to "overcrank" a little in order to "iron out" any problems. We had experimented with undercranking for many years and, in fact, had designed a control that interlocked the camera speed to the iris position so that camera speed may be varied during shooting with constant exposure maintained. This had been used effectively in a number of films that we had worked on such as THE CASSANDRA CROSSING, ESCAPE TO ATHENA and the New York flying sequence in SUPERMAN. The impression from the initial meeting for THE EMPIRE STRIKES BACK was that this undercranked ability would be valuable as a means to obtain the visual impact necessary for the aerial backgrounds.

The camera speeds suggested to us initially were in the order of 16 fps with perhaps a minimum of 12 fps. We felt that a 6 fps speed would be desirable to give a four-times-speed acceleration on the screen to the "Speeder" fighter craft. With this in mind, a note was made to set this speed as a minimum requirement of the VistaVision camera installation that we were still to design and build. I might mention at the outset that the attitude and cooperation of the people involved with production, Gary Kurtz, Robert Watts and Jim Bloom, was one of confidence and trust, so we were working under ideal conditions that no doubt had a positive effect.

Before we started shooting it was necessary to install a usable camera system for the 8-perf horizontal VistaVision format into the Wesscam mount. It was

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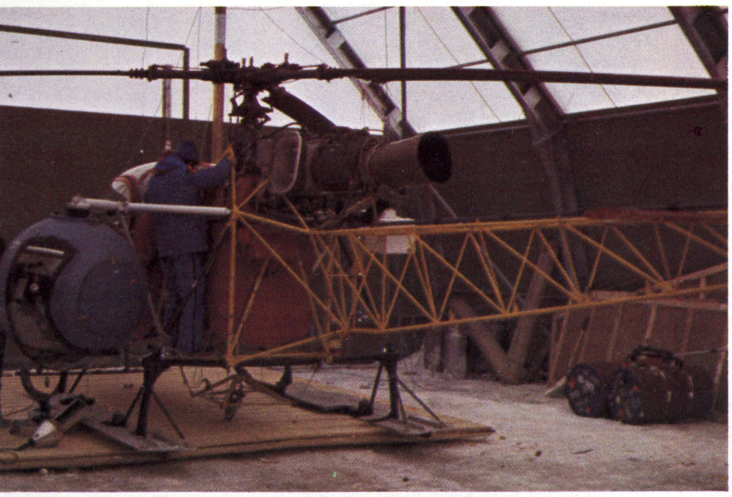
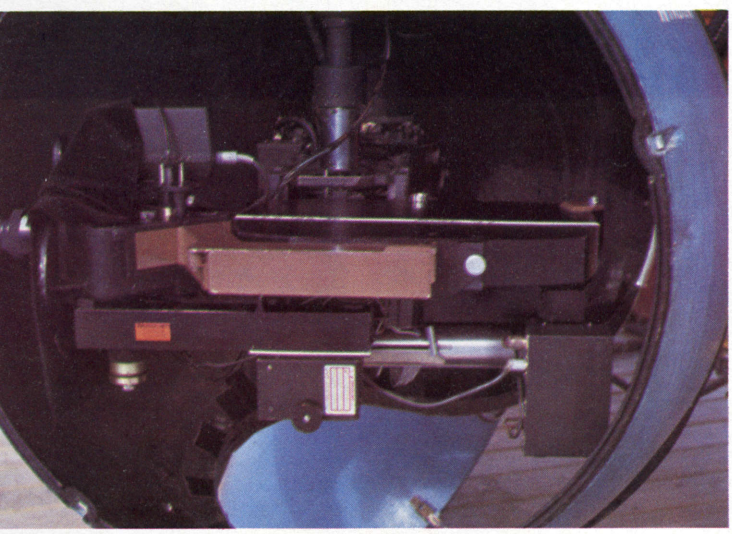
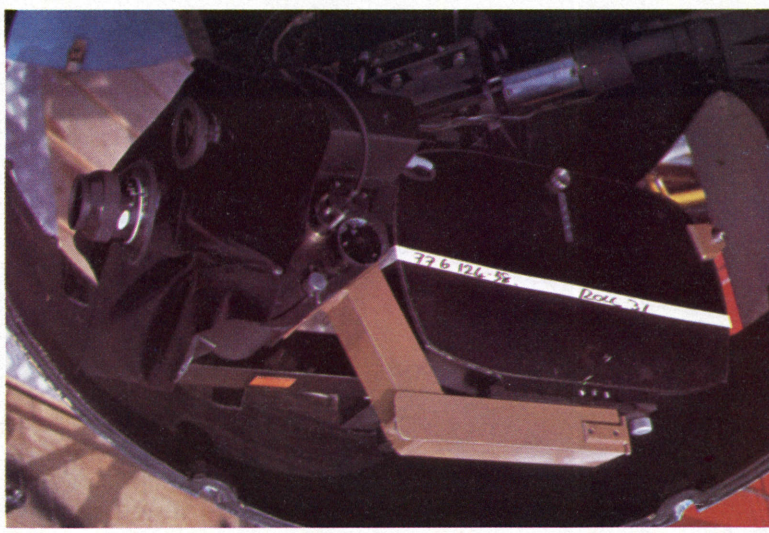


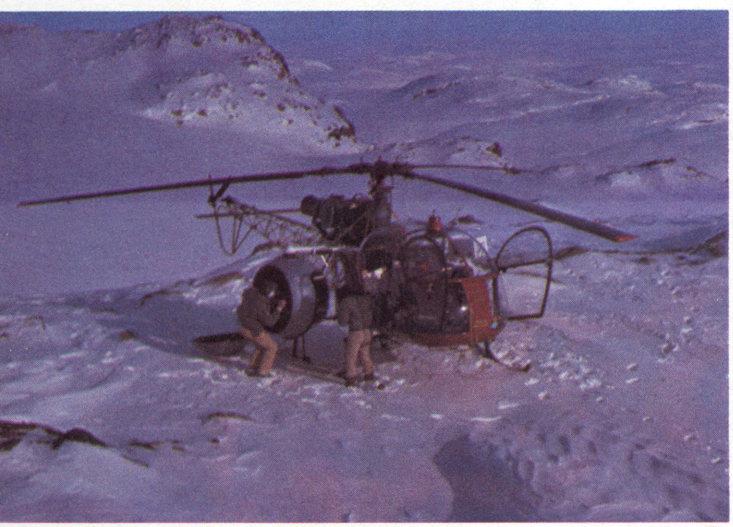
(LEFT) A tent-type structure was erected at Finse with electricity provided for heating both the helicopter and the camera system at night. (RIGHT) The helicopter is moved out of its shelter for action. When properly set up, the Wesscam remotely-controlled, gyro-stabilized system is capable of stabilizing an entire camera, magazine, lens and accessories to within .5 milliradian (about .045 degrees) in both elevation and azimuth (pan and tilt) with precise control.

Installing a VistaVision camera in a Wesscam mount presented problems. The lightweight "Paramount" version of the camera was selected, without look-through and based on the "butterfly" magazine arrangement, which involves a horizontal magazine positioned across the back of the camera. An adaptor channel guided the film from and to a Cinema Products 1000-foot XR35 magazine mounted lengthwise.





Given the glacier's altitude of 6,000 feet, plus the maneuvers involved, the Aerospatiale Lama 315B allowed a margin for safety. It was flown by veteran free-lance film pilot Marc Wolff. A control that interlocked the camera speed to the iris position permitted the camera speed to be varied during shooting with constant exposure maintained. To speed up the action, camera speeds of 16 fps and 12 fps were used, with 6 fps employed to lend a four-times-speed acceleration on the screen to the "Speeder" fighter aircraft.



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Continued from Page 524

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FUJINON INTRODUCES FIVE NEW LENSES AT NAB

Fujinon Optical demonstrated two new ENG lenses and one new EFP lens that are faster and lighter than the models they replaced, but at no increase in price. At the same time, Fujinon also introduced a new lightweight 22X EFP lens, and a new ultra-high resolution lens that comes with a 2X extender and test pattern projector built in.

On the ENG side, Fujinon's now offers a low cost 12x9 zoom and a new high quality 12x9 with a built-in 2.2X extender. By utilizing a compact servo unit and magnesium construction, the new lenses weigh about 20% less than the old models. Both offer f/1.7 speed and a 9 to 108 focal length. The extender equipped lens can also provide 19.8 to 237.6mm range. In both lenses, iris is servo, zoom is servo or manual, and MOD is 80cm.

A decrease in weight, increase in speed and maintenance of the old price highlight Fujinon's new 14x9.5EFP zoom with built-in 2X extender. It weighs 20% less than the old 14x10, again the result of magnesium construction and compact servo unit. It provides for wider angle shots and has been increased in speed from f/1.9 to f/1.7. Fujinon's new lightweight 22X zoom significantly advances the cause and the capabilities of the EFP movement. Weighing only 3.8 kg, the lens offers f/2.0 speed plus two zoom ranges. Normal range is 12.5mm to 275mm and by moving the lever controlled built-in 2X extender into place, the range is changed to 25mm to 550mm. Both EFP lenses offer the standard Fujinon features such as servo iris, servo and manual zoom and adjustable back focus for faster lens changing. For the new ENG and EFP lenses as well as those that have remained in the line, Fujinon continues to offer a complete list of accessories for studio conversion as well as range-extending converters.

The 14X ultra high resolution studio lenses introduced by Fujinon at last year's NAB have now been joined by a new version which includes the compact built-in 3-lamp diascope plus a built-in 2X extender. Fujinon's ultra high resolution lenses read 1300 tv lines, and are designed to deliver improved color convergence (the taking lens and zoom move together). In addition, the lenses can maintain maximum aperture in all zoom and focus ranges with MTF rated at 90% or better in green, red and blue. Standard and extender equipped lenses are available for both 1¼" and 1" formats.

For more information, contact: Fujinon Optical Inc., 672 White Plains Road, Scarsdale, New York 10583; or, on the West Coast: Fuji Optical Systems Inc., 4855 Atherton Avenue, San Jose, California 95130.

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NEW ARRI FOLLOW-FOCUS SYSTEM

Arriflex Corporation announces the availability of the new ARRI Follow-Focus System for 16 and 35mm Arriflex cameras.

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For further information, please contact: Arriflex Corporation; One Westchester Plaza; Elmsford, New York 10523. ■

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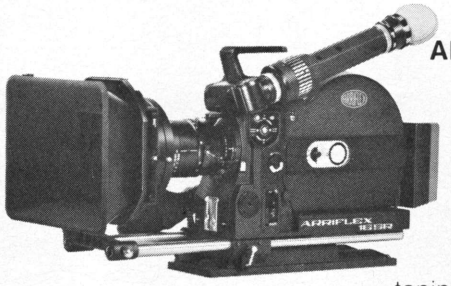
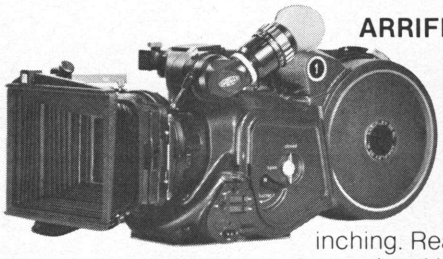


ARRIFLEX 16SR A completely new 16mm reflex design with motor built into camera base for better balance and silent running. Lightweight unit accepts 400' instant-change magazine; onboard or outboard batteries. Has video tap for optional simultaneous taping and/or monitoring, thru-lens meter, crystal control, optional variable speed, auto servo exposure, 5-way rotational finder, much more. 50/60 Hz, 24/25 fps.



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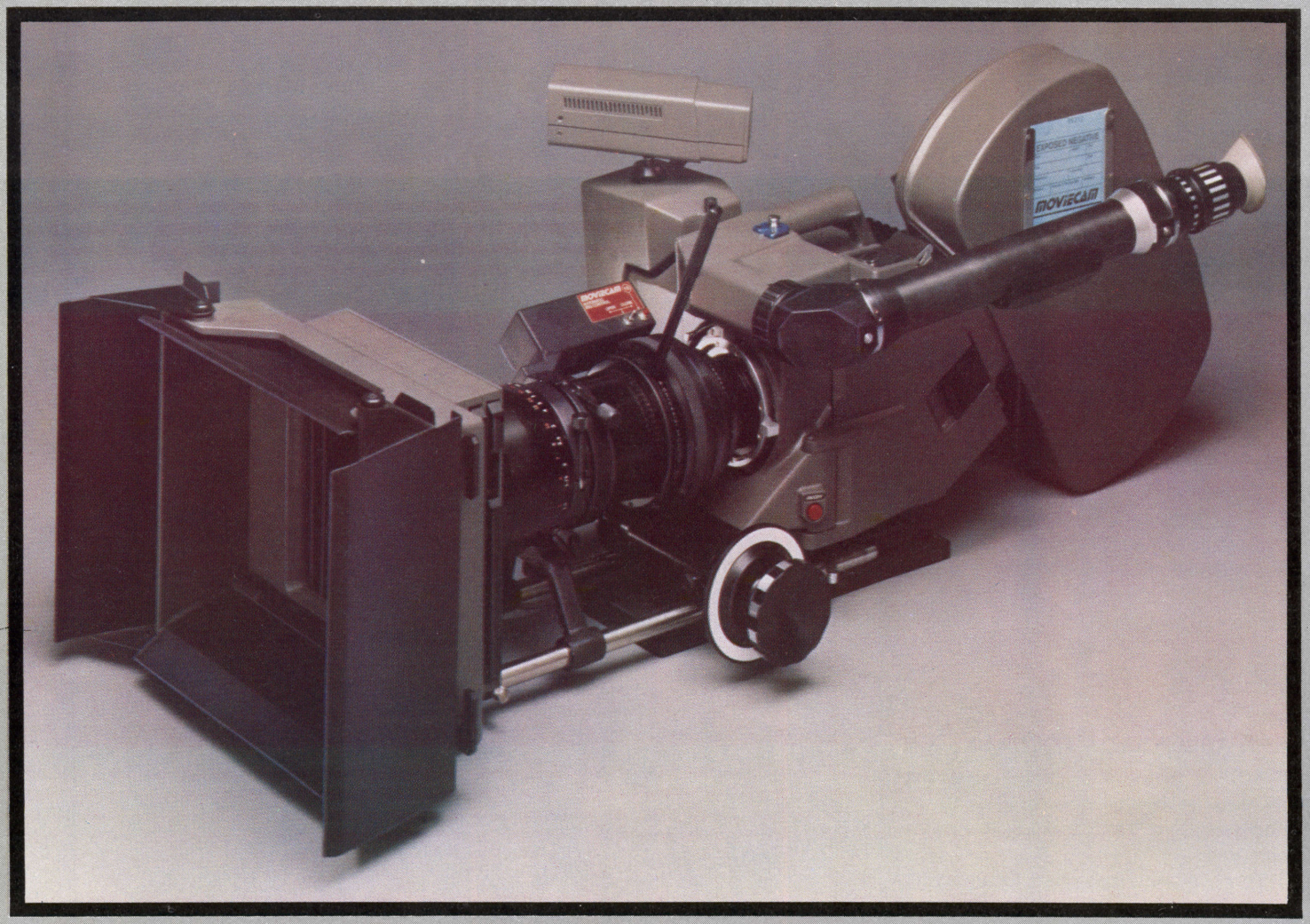

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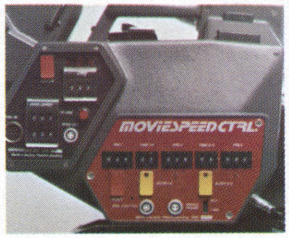

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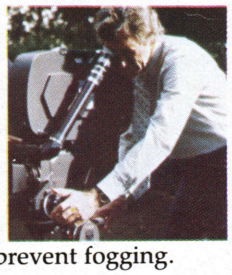

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screenplay, RAIDERS OF THE LOST ARK, based on another George Lucas' story, which is to be filmed this year with Steven Spielberg directing.

The key specialists on the new picture include several who had worked on STAR WARS. Robert Watts became associate producer, Norman Reynolds production designer, Paul Hirsch film editor, Ralph McQuarrie design consultant, Stuart Freeborn make-up supervisor, John Mollo costume designer, and John Williams again wrote the musical score. Of these, Williams, Reynolds, and Mollo had been honored with Academy Awards for their work on STAR WARS. Newcomers include Peter Suschitzky, BSC, Director of Photography, and Brian Johnson, who supervised the mechanical special effects during principal photography and later joined forces with Richard Edlund and Dennis Muren, supervising the creation of special effects at Industrial Light and Magic.

The young heroes of STAR WARS resumed their roles in the continuation: Mark Hamill as Luke Skywalker, Harrison Ford as Han Solo, and Carrie Fisher as Princess Leia Organa.

Also returning were Anthony Daniels, who had made so unique a contribution to STAR WARS with his interpretation of the character, C-3PO; David Prowse as Darth Vader; Peter Mayhew as Chewbacca; and Kenny Baker as R2-D2.

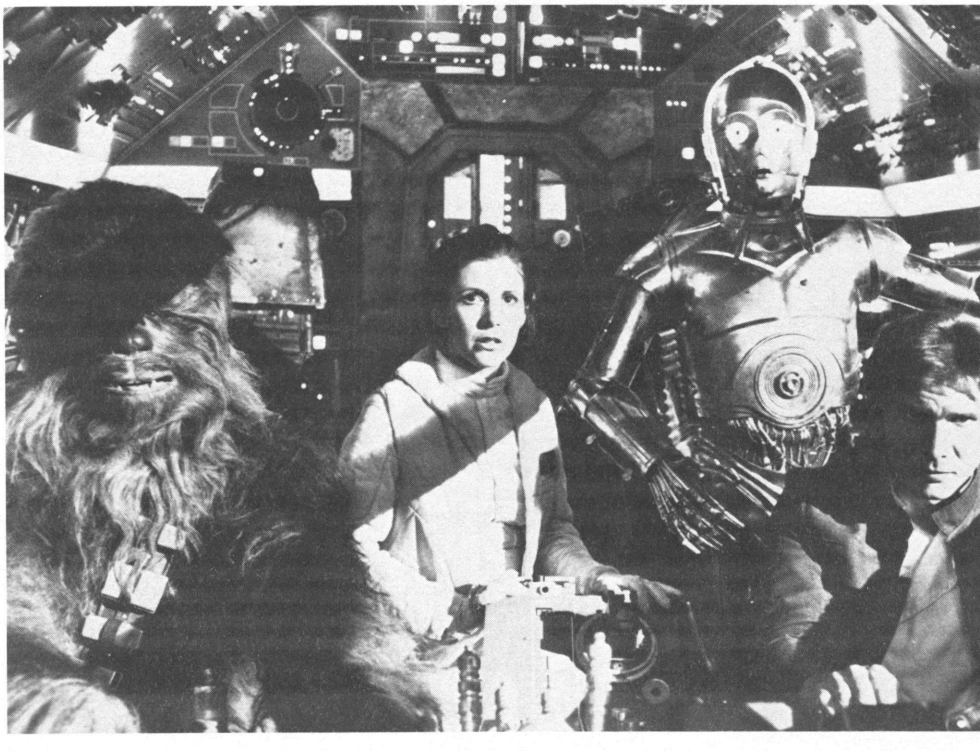
The company was then complete—with one important exception, Sir Alec Guinness as Obi-Wan (Ben) Kenobi. When the pictured started shooting, Guinness was still recovering from an eye operation and his availability was in doubt. It was not until almost the end of shooting that it was confirmed that he would appear, reflecting not only an improvement in his health but also his desire to continue his involvement in the STAR WARS saga.

Two new characters have been added to the entourage. Billy Dee Williams has been cast as Lando Calrissian, the charismatic boss of a mining colony in space.

Frank Oz, who is famous for his "*Muppet Show*" characterizations on television, appears as Yoda, an entirely new creation which is expected to be one of the most talked-about debuts of the year.

To accommodate the picture at Elstree, where all eight existing stages were used, an additional facility was built. The studio lacked an appropriate stage, and one was needed for the most elaborate of the interiors. When completed, it became one of the largest stages in the world and an important new facility for the film industry in Britain. Foundation work was finished before the winter of 1978/79 locked the country in a grip of ice. It was to prove one of the worst winters on record, and its length and severity delayed the completion of the new stage. Nevertheless, scenes on both the ice planet and the jungle planet were eventually shot in it. The dimensions of what is now called the STAR WARS stage are 250 feet long by 122 feet wide by 45 feet high, adding up to an overall capacity in excess of one-and-a-quarter million cubic feet. large enough to accommodate a soccer game, the biggest of the interior sets nevertheless required a 30-foot extension to it!

Director Irvin Kershner, producer Gary Kurtz, Executive Producer George Lucas and screenwriter Lawrence Kasdan on the set of THE EMPIRE STRIKES BACK. (BELOW) Among the popular characters retained from STAR WARS: Chewbacca (Peter Mayhew), Princess Leia (Carrie Fisher), C-3PO (Anthony Daniels) and Han Solo (Harrison Ford), shown in the cockpit of the Millennium Falcon.



More evidence of the scale of the production was the building of a full-size version of Han Solo's spaceship, the *Millennium Falcon.* A firm of maritime engineers at Pembroke Docks, Wales, 250 miles west of London, constructed the *Falcon* in a hangar once used to build the giant Sunderland flying boats of the 1930s, a craft which spanned the passenger routes of Britain's then still-extent empire. On completion, the spaceship, weighing over forty tons, was divided into sixteen interlocking sections and moved in a convoy of trucks through Wales and across southern England to London. At the studio, it was re-assembled, fitted with compressed air pads, similar to those on hovercraft, and "floated" into position on the STAR WARS stage.

Start of production was set for March 1979, but prior to that date, something happened that severely affected the picture's scheduling. Stanley Kubrick was still using Stage 3 at Elstree for THE SHINING, and on the night of 24 January, Stage 3 burned down, gutted in a flash fire that may have been caused by a discarded cigarette. The cluttered driveways of the studio complex prevented the local fire department's trucks from getting in, and by morning, the stage was a smouldering ruin. Because the STAR WARS team had been waiting for Kubrick to finish before moving into Stage 3, its loss meant a complete rescheduling. Moreover, Kubrick had to revamp his set on another stage, virtually denying two stages to THE EMPIRE STRIKES BACK.

However, the work of preparing the production was not centered entirely around the studio in England, because the first scenes to be filmed would be shot on location in Norway. At Finse, a remote mountain pass 5,000 feet above sea level, on the rail link between Oslo and the port of Bergen, preparations had been going on for months. High above the pass, and well above the vegetation line, stark and precipitous, stands a glacier sheathed in a veil of blue ice. On that foreboding icescape would be filmed the battle for dominance of the frozen planet of Hoth. It was at Finse on 5 March 1979 that principal photography began.

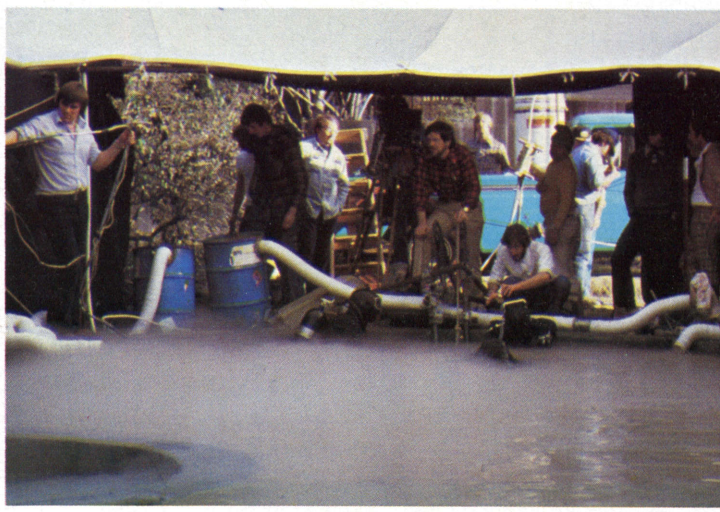
The location base was the Finse ski lodge, normally used by cross-country skiers in terrain which, even in an average winter, is particularly hostile—Robert Scott went there to train his Antarctic team—but the winter of 1978/1979 was to prove one of the worst in living memory. For several days, the seventy technicians and actors based there were cut off by avalanches that shut down the railway line, severing physical connection with the outside world. An arctic survival camp built to headquarter the crew at the glacier's summit was buried, and the filmmakers experienced "white-outs" in which blizzards whipped the snow into a blinding powder. Nevertheless, repeated attempts were made to shoot at the summit, and those of the second unit, under the direction of Peter MacDonald, were eventually successful.

By 12 March, the first unit had assembled at the studio, and filming on the interiors began. For seven months, the filming occupied every foot of stage space at Elstree, including the new STAR WARS stage, which became operational in May. Soon it became clear that the picture had been underscheduled, particularly in view of the effects of the fire and the severity of the conditions in Norway.

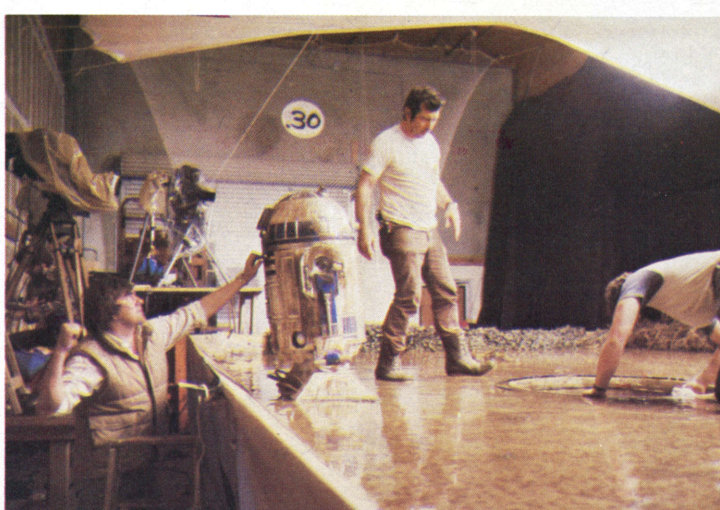
Continued on Page 627

THE EMPIRE STRIKES BACK, like its enormously successful predecessor, STAR WARS, is an intergalactic fairy tale populated by all manner of strange creatures, both biological and mechanical. (ABOVE) Weird beasties take shape in a production workshop. (Photo: David Steen.) (BELOW) Bits and pieces of C-3PO and an Empire Storm Trooper. (Photo: Richard Blanchard.)

Cataclysmic battles involving gigantic spaceship were staged and photographed at the ILM facility in San Rafael, California.



(LEFT) Joe Johnston (right), special effects art director, demonstrates scale relationship between Speeder and Walker models, while Richard Edlund and Brian Johnson look on. (RIGHT) Crew working around pool used for swamp shot. (Photo: Terry Chostner.) (BELOW LEFT) Ed Hirsh hands R2-D2 to Ted Moehnke, supervising stage technician, from swamp set. (Photo: Howard Stein.) (RIGHT) Brian Johnson, Ted Moehnke and Bob Finley work on effect which shows R2-D2 getting spit out of the swamp on the planet Dagobah. (Photo: Terry Chostner.)



Continued from Page 559

do a temporary recomposite very quickly, there is a much quicker turnaround in redoing things—which you need. Otherwise you get bogged down, because there is so much drag in the machinery when it comes to getting separations done. That's the way it normally used to be—in my past experience, anyway. The system they have here has offered a great saving and a great benefit to the production.

QUESTION: Since George Lucas lives near here, I would imagine that his proximity is another plus, isn't that so?

JOHNSON: Yes, the fact is that we have George here pretty much all the time, so there aren't any problems when it comes to getting his judgment on something. After all, he is basically the guy who is making the movie and it's very handy to be able to get immediate feedback from him. He is basically a storyteller and has an innate sense of timing. There is obviously more than one way to do a shot and more than one way to cut it, as well, but we just refer everything to George and then get his feedback, which is a great help. There aren't a lot of people saying, "I think we should do this or that." That happens on most pictures, but it's great to be able to listen to what George says and then interpret that to the best of your ability—then, if there are any changes to be made, to have a direct feedback on the changes. Being able to work that way has been a great help.

QUESTION: It would strike me that there would inevitably be some problems based on the fact that the live action has been shot in England, while the effects have been shot 6,000 miles away in California. Is that true or not?

JOHNSON: I know that on STAR WARS a number of problems of that sort did occur, because there wasn't as much passing of information as there probably should have been, but I think that this time it has worked pretty well. The ideal situation would be to have some sort of video link, so that we could talk back and forth during production, instead of having it take a day or two for things to filter through from England. It would be very helpful to be able to look at images and say, "Yes, okay, we can match that." I think that could happen on the next production; it would be yet another step forward. It's always a problem with that gap of 6,000 miles, and you can't be in both places at once, nobody can. Because Irvin Kershner was directing and not George, sometimes little things would happen and George would say, "We don't really need this. We need that." They were really very minor things. But basically the communications between the two units worked out very well, especially in regard to special effects. I think that's probably one of the reasons why I was engaged for the project—the fact that there would be one overall supervisor, as compared to the last time, when there were two separate entities and the whole English thing was really totally divorced from this side. It created a few problems on STAR WARS, but they haven't really occurred this time.

QUESTION: Do you have any final comment on your EMPIRE experience?

JOHNSON: Only that I think the photography on the Walker animation sets is some of the best stuff I've ever seen. I know that some of the English crew that were out in Norway shooting the live action will find it very difficult to believe that the animation shots could tie in so well with the Norwegian footage. You can look at it and you can look at it again and you can't tell which is Norwegian and which is animation. In fact, on one particular sequence we actually matched the Norwegian landscape because we hadn't received enough live action footage of the specific area. So we matched it and it's cut in with the other stuff and you can't tell the difference. Dennis Muren and Phil Tibbett and Jon Berg have done an amazing job on it—absolutely amazing. In fact, I think this must be the most professional crew around—a wonderful crew. ■

Like a robot wrangler, Brian Johnson rides herd on a clutch of remotely-controlled R2-D2 droids in the process of being assembled. EMPIRE is the kind of film in which thousands of mechanical and electronic elements, both in front of and behind the cameras, had to come together and work in a seamless fashion. They do! Photo: David Steen.)

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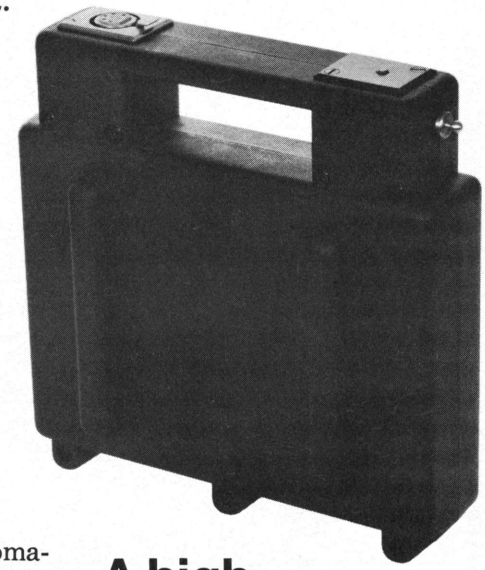

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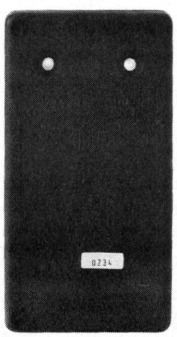

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SPECIAL VISUAL EFFECTS
Continued from Page 567

On EMPIRE, just as on STAR WARS, we have used lenses with tilting mounts for shooting our miniatures. That was the first thing I decided we needed on the camera. It harks back to my days as a still photographer. I started out with a view camera and soon learned the advantages of being able to tilt the lens to achieve more depth of field than was normally possible when the lens was parallel to the film plane. If you are photographing (as you are in most cases) an object which is tilted toward the lens, such as a landscape going out before you, and you see the foreground three feet away and it goes back to infinity, and there are just clouds or a bald sky, you can achieve focus from two inches to infinity by tilting the lens forward. The cardinal sin in miniature photography is to have something soft in the foreground; that immediately brands it as a miniature, so you must have extreme control over your focus.

This is by no means the first time that motion picture lenses in tilting mounts have been used. Actually, the late Hal Mohr, ASC, had a ball-joint 50mm lens in his goodie box, which he would drag out and astound people with occasionally when the need arose, so I'm really just carrying on the tradition. A tilting lens board, to me, is an absolutely necessary part of miniature photographic equipment. We have several focal lengths available with tilting mounts.

We chose Nikon lenses for our special effects work because they have the best range of optics for the SLR cameras. The fact that there are so many SLR lenses available is another good reason why VistaVision (or an 8-perf, pulled-across film format) is the best effects format. We have a range of lenses from a 13mm rectilinear wide-angle lens to a 1000mm mirror lens and all of the units in between. All of the focal lengths have one flange distance; they all have the same filter ring size. They are all of the same color, so they intercut well. One doesn't tend to be yellow and another one blue, causing that sort of problem. They are all very close to being the same in terms of the look they produce. By that I mean that one isn't crisper than the other one. There are, of course, certain lenses that are the sharpest and that we use for specific purposes, but from the wide-angles to the longer lenses they are all about the same quality, which is an advantage. Another plus is that we are able to buy these lenses for a few hundred dollars each. We'd have to think a little bit harder about using VistaVision were it not for the range of lenses available in that format.

I'd like to go into a bit more detail about the cameras we built for THE EMPIRE STRIKES BACK. We decided that if we were going to go ahead and design a camera, several could be built. As I mentioned previously, we've built two at the present time. One of them has a range from sound speed to unlimited time exposure. The other one presently goes from 96 fps to one second, but at some point this camera will be capable of going from 96 fps to long time exposures, as well.

We decided to build a VistaVision reflex camera because a reflex camera is generally the most pleasant to use, the most versatile and you can see what you are shooting as you shoot it. You can also add video viewfinders to relay the exact image that you are photographing.

It's very tricky to design a mirror reflex system and get it to a point where the image is steady, but, nevertheless, we decided to do that and we have done it. The camera is small. It uses Arriflex magazines, which is the only sane way to build a special-purpose camera, since part of the camera is already built into the magazine. You only have to drive your magazine and you have the loop formed for you automatically.

The magazine load is rather small—only 400 feet, but still an improvement over the 200-foot load used in standard 35mm photography. At any rate, since these are Arriflex magazines, they can be changed rather quickly. Since our cameras were designed specifically as effects cameras, we were not interested in putting 2,000-foot magazines on them for production use.

Our camera design includes a bloop light which sends a pulse to the recorder if you need to record sound. It has a ground glass viewing device which permits you to put a film clip in the finder on pins that are registered to and lined up with the register pins in the camera. This makes it possible for you to look through the clip and compose a matte shot in relation to a miniature previously shot, or vice versa. You can line it up exactly and see the perspective of the other shot in the finder. You can match forced perspective shots and things of that nature. As far as I know, this is the only reflex camera that has that capability. There are rackover cameras that have it and it's now a new idea. What we have designed is just a new implementation of an old idea. Much of our new effects technology has evolved that way, based on tricks that go all the way back to the original KING KONG.

The camera has a reflex butterfly-type mirror shutter, which is similar to that used in most reflex cameras. The shutter is traditional in that it is one-to-one to the

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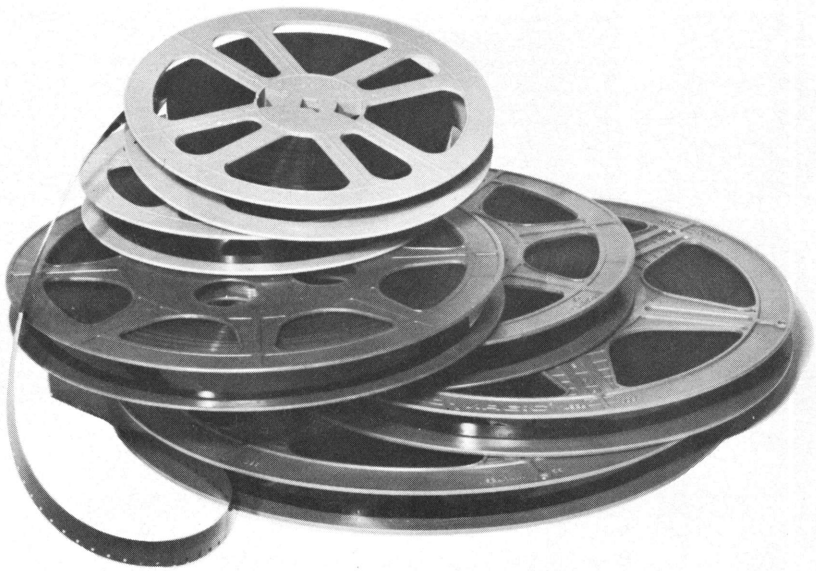

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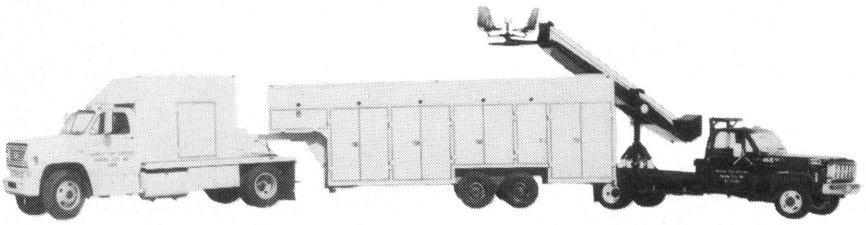

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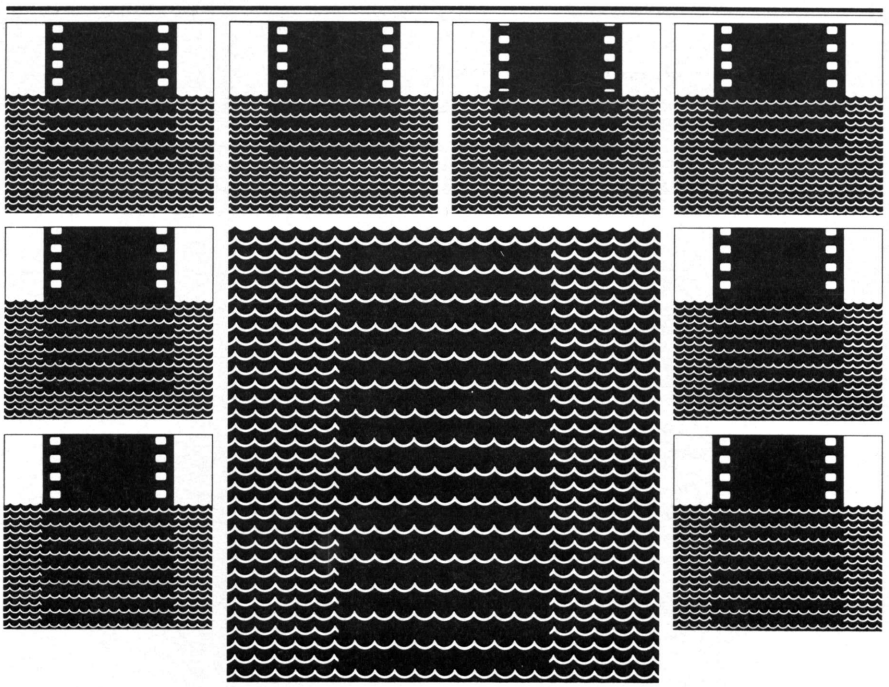

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movement, which means that there is no chance of one frame getting a slightly less amount of exposure than the other frame. Such a problem would be much more pronounced in our work, since we have to deal with the image in duplication so many times. We have one shot in THE EMPIRE STRIKES BACK that has 20 separately photographed blue screen shots, each of which was put in as a separate item, and we managed to achieve matte density without matte lines of sufficient amount so that the scene didn't start to get milky after putting that many elements in.

Eastman Kodak has been very generous and very helpful to us on this production. We asked them to make 5247 on an Estar base for us and they agreed to do so. As a result, we shot all of our special effects on Estar base film, including the high-speed work and all of the separations, mattes and other elements. There were five different emulsions that we received on Estar base, 5247 being the first. The separation stock, 5235 had been supplied previously; 5369 had been supplied to the microfilm industry previously. I don't know about 5302, which we use for mattes sometimes. However, this was the first time they'd ever put 5247 on Estar. The live photography was not shot on Estar base, but the matte shots were wherever possible and this gave us a somewhat better dimensional stability than we were able to get on acetate base. Not that there is anything wrong with acetate base; it's just that because our parameters are so stringent and we deal with so many elements, there are many factors that play in our favor with Estar base. Even our daily prints came back on Estar, which meant that they didn't get chewed up in the projectors. Such accidents, which are common with acetate prints, would have killed us timewise, because we would have been forced to wait for reprints. The toughness of the Estar base 5247 was important to us, but our main reason for using it is its dimensional stability. ■

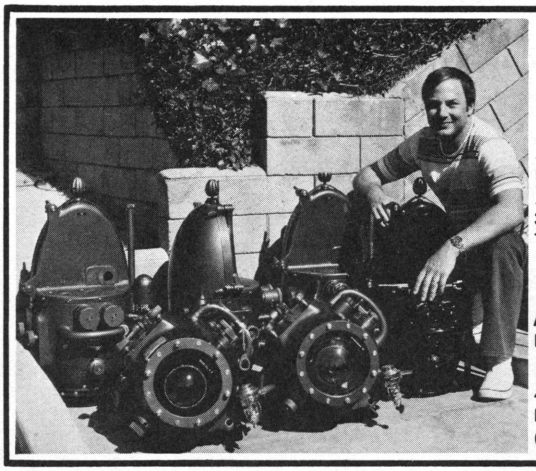
(ABOUT THE AUTHOR: Co-supervisor of special visual effects RICHARD EDLUND was born in Fargo, North Dakota. He attended the U.S. Naval Photographic School, and later the UCLA Film School. Apprenticed to the Joseph Westheimer Company in Hollywood for four years, he worked on the opticals for such television series as THE OUTER LIMITS, THE TWILIGHT ZONE and STAR TREK. In 1968 he made a documentary film about the 'American Sculptures of the 1960's' exhibition at the Los Angeles County Museum. His experience also includes working on album covers and graphics for the rock music industry, making experimental films in San Francisco, providing graphics for the ABC network and many commercials, which introduced him to motion control and electronic camera work. His film credits include THE CHINA SYNDROME and STAR WARS, for which he received an Oscar.)

MATTE PAINTINGS FOR "THE EMPIRE STRIKES BACK"
Continued from Page 584

other words, Luke was just photographed against blue, spinning on a wire with a tied-off camera. What we had to do was have him come in from the top of the frame, follow him down the shaft, and then have him go away. So his rear-screen elements had to be projected with motion control. We had to do a move on that, as well as match the move on the paintings. It's quite believable.

In that sequence there are probably a dozen paintings. Some are combined; most of them are front-projection. (One of the advantages of front projection is that we are able to take a plate and reduce it slightly, thereby helping to maintain the quality.) Some of the paintings were shot as backgrounds for blue screen elements. When I saw the finished film for the first time—which was, of course, very exciting and filled with anticipation for me—I noted that the sequence flows very smoothly. The blue screen footage and mattes cut together with the production footage quite smoothly and I don't think many people will be aware of the differences. Of course, as is George Lucas' method, he cuts very quickly, as well, and the story is very exciting at that point—all of which helps.

The matte paintings for the Cloud City sequence were exteriors used as backgrounds when the Millennium Falcon (Han Solo's spaceship) lands on a pad and takes off later. They served as transitional shots between the approaches to Cloud City through the clouds and the interior. Those were kind of quick throw-aways, but I think they worked pretty well because, in this case, you've got a matte shot that obviously has to represent something other than reality. Everybody knows full well that there are no cities that are floating in the clouds—and nobody has yet built one for a film—so it has to be produced by some degree of cinema magic. But these are the kinds of matte shots that always worry me. When you are extending actual sets or putting in backgrounds of hills and mountains, something that the audience can relate to as being real, then if you've succeeded the audience won't notice it. But with a Cloud City, people will say: "This has to be a painting; it has to be a miniature; it has to be *something,* because a city floating in the air can't possibly exist in reality." So shots like those are perhaps the most anxiety-producing mattes of all. Ralph McQuarrie did a good number of those paintings and, of course, he had a great deal of design sense for Cloud City. Also, the sequence takes place at sunset, which gives the visuals a nice, eerie,



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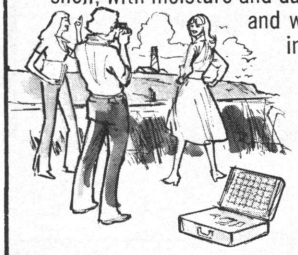

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other-worldly glow. I hope all of these things combine to create the illusion successfully.

All that matters is if the audience will believe it on the screen. The fact is that people who know nothing about how these things are done can still tell us whether the effect is good or bad. You don't have to know what a 10K is to know whether you like or dislike a movie, and that's something we tend to forget. We say, "What do they know?" But they *know.* They've used their eyes all their lives and they know when something doesn't look exactly right. There isn't a little sign that pops up in front of their faces and says, "matte line" or "jiggle" or "dupe". It just says, "Oops!" It distracts them. It takes their minds off the story. THE EMPIRE STRIKES BACK has a terrific story, an interesting story, a strong story—and that's where your mind should be. Anything technical that jars you a little bit is going to distract you. So your effects have to flow and fit in neatly. I hope they do in this picture. I *think* they do. I've seen it once and I was quite pleased.

For our front-projection set-up we had a Bell & Howell camera box, which we also used for the bi-pack situation. It had a bi-pack capability on top with a 100mm Cinemascope (Bausch & Lomb) lens.

The projector, which was a VistaVision projector, was constructed at ILM; the lamphouse was designed and constructed partly at ILM; some of the optics were designed outside. So the lamphouse, which was sort of made from scratch, was set off 90 degrees from the camera. We had a beam-splitter piece of glass through which we projected the image onto front-projection material, which we put behind the glass. As a result, because we had this material behind the glass, we had to tilt the painting slightly so that you wouldn't see a direct reflection of the light source back into the camera. That kind of solved the problem.

We didn't want to put the front-projection material on the front of the glass initially because we weren't sure how much of the image we would use and we thought that would create more problems for us. But we tilted the glass (we had front-projection material in back of it) and then generally shot the painting and the plate in two passes, or, in the case of separations, obviously in four passes—but we shot the paintings separately from the front-projection. We did this not because we had to (you could turn on the lights and shoot the painting and the plate all in one), but because it gave us a little more control, in that we could vary the amount of light on the painting in relation to the plate. We could do exposure wedges on the painting, as well as the

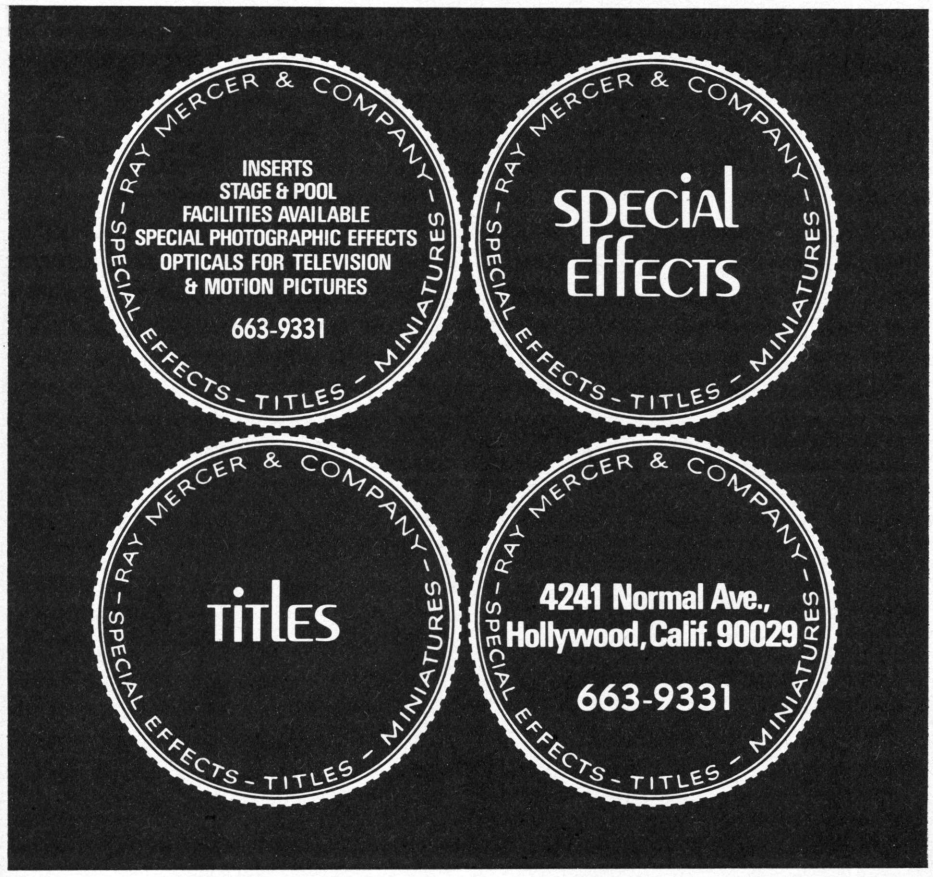
plate, and bring the two of them together, rather than having to be locked in to one set of exposures for both. That offered us a bit of advantage.

The camera had a motion-control device that allowed it to tilt and pan. Obviously the camera lens was not a zoom, so we were not able to move in or out, but we found that we could eliminate a number of moves from the paintings. I had originally instituted moves, but found that they really weren't adding anything to the shot, so I moved probably far less in this picture than I did for THE BACK HOLE. I think that's also one of the reasons that the shots are quite short—one second, two seconds, four seconds, maybe six seconds; the longest one was eight seconds. That's a pretty short amount of time and introducing a move could sometimes be a little disorienting and not particularly prove anything. There is nothing worse than an unmotivated camera move. I think that probably out of all our shots we had maybe three or four moves. It wasn't because the equipment wasn't up to it, but simply for the reasons I've stated.

The type of front projection we were using is different from conventional front-projection in which you have live action going on in front of a projected plate, but it creates its own set of unique problems in that the screen is much closer to the camera than 3M recommends. You have to be much more critical with your line-up in order to avoid matte-line problems. Anytime you try something that is markedly different you may solve one problem, but create three more. It's like going ahead one foot and slipping back three. But this method had been used fairly successfully on THE SPY WHO LOVED ME and that really got Richard Edlund thinking that front projection would be a very viable method for THE EMPIRE STRIKES BACK.

You can work much quicker with front-projection than you can with rear-projection. Because you have a very bright light source your exposure times are very fast, which is terriffic. You can whip off all your shots very rapidly. Rear-projection, as used at Disney Studios, has tremendous advantages, but when you have to take six, seven or eight hours to do a shot, it can get a little frustrating, especially toward the end.

We bi-packed the shots that we felt were extremely critical qualitywise. We have two shots in the picture that have a power generator in the background, and one of them had to be done optically. In other words, we shot the power generator with front light and then with back light and gave those elements to Bruce Nicholson in the Optical Department. He then composited them optically. We also did a similar shot ourselves with bi-pack.



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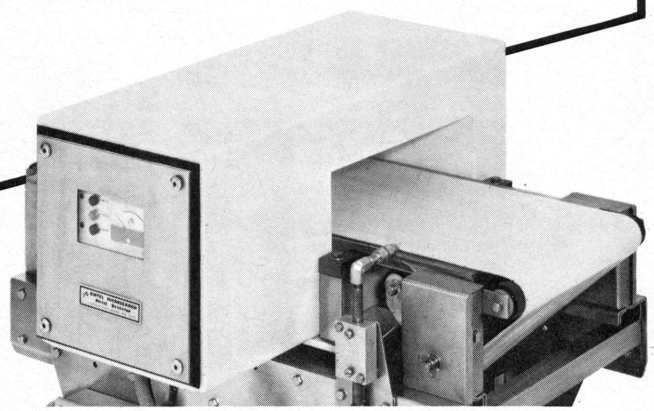

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Both shots look good, but each is a bit different. I don't know exactly why they are different, but I think his added a little contrast and ours took away a little contrast. The reason we used bi-pack was that we were very concerned with quality, because we had a sequence that took place in the snow and there were a number of mattes that had big areas of snow that would show up grain quite easily. I think that's one of the main things you have to worry about—giving your shot away because of a lack of quality in the dupe.

We probably had 10 or 15 mattes in the snow sequence, but they were relatively less complex than most of the others. We got those finished toward the beginning. We had a couple of shots of an ice cave entrance, one of which was put together optically because we had a stop-motion figure that went into the cave. I had a shot looking out the window of one of the Walkers as they approached the trenches.

I don't think anything we did on THE EMPIRE STRIKES BACK could be called startlingly innovative because, as is so often the case, we were using ideas and methods that had been used before many times, going way back. Motion-control, of course, is a sophisticated technique and it has been a terriffic help, but all it has really done is taken the place of a man sitting there with a lathe-bed or Acme screw-drive, making one little turn at a time for each frame. I'm not downplaying motion-control, because it has cut the time factor down tremendously and, thereby, increased flexibility. It gives you shots that you wouldn't have been able to attempt before, because the man-hours just did not exist, nor the patience, nor the reliability. But I think that everything we do today is still, at the most, new applications of old ideas. When it comes right down to it, we are still using 35mm film that has perforations along its sides and this is old-fashioned, but nobody has come up with anything better yet. We simply try to eliminate the variables and get it down to its nth degree and make it as good as we can.

So there was nothing really innovative in what I did on EMPIRE—just six months of problem solving, of deciding to go with front-projection and finding that there is a reflection in the glass because you put the screen in back of it, lining up the camera, figuring out how much you are going to tilt the painting and mechanically what kind of little goodies you are going to put on it. These are all problems which, perhaps, have been tackled before and solved, but they were in a slightly different context; maybe the set-up was bigger. Anyway, each time you change a little

something you just institute another problem that has its own unique way of being solved and, hopefully, you can come up with the solution before you run out of time.

In working the special effects areas, especially on a really big picture, too many people get caught up in the fine points and fail to be aware of the overall reasons for the shot, the reasons for the show, the big picture kind of thing. It's almost like trying to find out what kind of colors Rembrandt used and how he set them up on his palette and thinking that this will allow you to paint like Rembrandt. Those are interesting things to know, but they are just tools, but eventually you've got to come down to doing it and keeping in mind the purpose of the shot.

The purpose of the shot is to get from the preceding shot to the next shot and move the story along. It gets said so many times, but it gets forgotten so easily when you're in there pulling your hair out because you've got a scratch on your yellow record. It's difficult to remind yourself of why you are cursing and swearing. Of course, you are cursing and swearing because you have to remake your separation master, but basically there is a purpose for it all. I forget it continually and I have to hit myself over the head occasionally and not look at that, but keep getting back and looking at the shot and saying, *"Is the shot doing what it's supposed to?"*

I think that's the basic. That's the bottom line—easy to say, difficult to do. ■

(ABOUT THE AUTHOR: Matte painting supervisor Harrison Ellenshaw was born in Harrisburg, Pennsylvania, but spent his early years in England, while his father, Peter Ellenshaw, worked in the British studios. When his father moved to California (to work on 20,000 LEAGUES UNDER THE SEA) Ellenshaw studied psychology at Whittier College, obtaining his bachelor's degree in that subject. Following graduation, he served two years with the U.S. Navy. In 1970 he joined the Disney studios and eventually headed their matte department, working on such films as PETE'S DRAGON and THE BLACK HOLE. His other credits include THE MAN WHO FELL TO EARTH and STAR WARS.)

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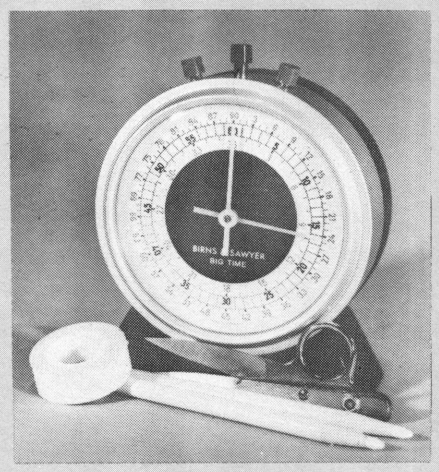

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COMPOSITE OPTICALS FOR "EMPIRE STRIKES BACK"

Continued from Page 571

seemed to solve many of our edge problems without sacrificing the blurred motion we needed to maintain the dynamic of the shot. We utilized 5302 (Kodak black and white release print), and 5235 (separation stock) for matte generation throughout the show. These stocks were Estar-based so as to prevent shrinkage and distortion.

EMPIRE also presented the optical department with the problem of having to composite 415 shots in less than one year. We utilized an "Apple II" computer to help streamline our line-up system. Through the programming skills of Jim Veilleux (ILM stage cameraman) and Dave Berry (optical printer operator), we were able to have our count sheets printed out on the "Apple." This newfound capability eliminated many of the computation errors associated with generation of separation positives and their corresponding mattes, saved us time and eliminated much of the monotony involved with the task.

When a new shot came in to optical, all the line-up persons had to do was to take his sync counts from his work prints and original negative, noting any crossover information, feed it into the computer, and his count sheet would be printed out. Our line-up department, headed by Warren Franklin and Mark Vargo, successfully applied this system to the most complicated shots in the show.

The white background plates that were used for most of the snow battle sequences were shot in Norway during one of the worst winters in the past 100 years. The crew was forced to shoot on extremely stormy days with only a few days of sunshine available the whole time they were there. Also, there were helicopter plates shot without an ultraviolet absorbing filter which further disturbed the continuity. This created considerable problems for optical. Through filtering during the composite process, we were able to eliminate many of these mismatches, while matting in various foreground material in the same shot.

It took every ounce of ingenuity our crew possessed to make these sequences work. Discussion, planning and story-boarding were a key to the successful realization of these shots. After 1½ years of extraordinary labor, ILM's optical crew composited a total of 415 shots, making George Lucas' THE EMPIRE STRIKES BACK a cinematic reality. ■

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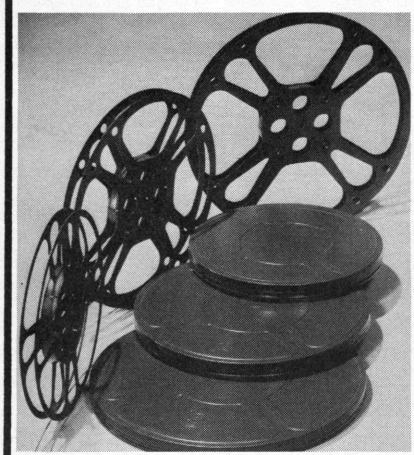

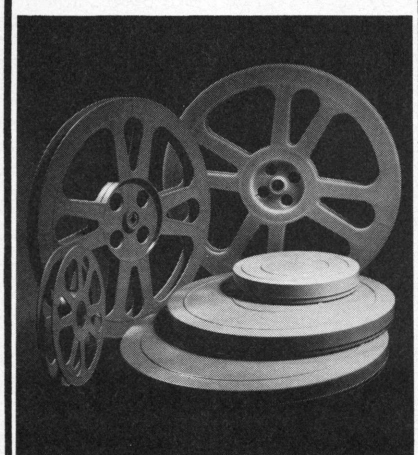

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EFFECTS PHOTOGRAPHY FOR "EMPIRE STRIKES BACK"
Continued from Page 592

a show like this, but it didn't make much difference.

QUESTION: What was your reaction to having to give up the shooting phase in order to move into your supervisory capacity?

MUREN: There were a lot of interesting management problems I had to face, and most of it just involved discipline. You can take something as far as you can and say, "That looks really good and I think we ought to shoot it." Then you stop and say, "Wait a minute. Maybe with just a little more effort—and only another ten minutes, but a lot of thought in that ten minutes—we can make it better." Then a number of people would gather around and look at it. We'd stop and run into the projection room and show another shot that we'd done, and we'd analyze it and have roundtable discussions (very quickly) as to what we could do to make it better, and often we'd come up with a nice degree of reality that didn't come from a hurried, cluttered atmosphere. But the discipline required to take something beyond what most of us here had ever done before resulted in a very interesting perception. So often in this work, for many reasons (financial or whatever), you take it to a certain point and that will be it. But they've been very nice here. We've had a lot of time to do this work. I must say also that the teamwork of this crew has been just the greatest. What I do miss is the motion-control programming. This is practically a new art form in itself. Here at ILM most of our spaceship motions are made by hand, instinctively, with a joystick by the cameraman himself. It's fast and allows the cameraman freedom to add his style to the shot. Cameraman Ken Ralston, for example, is also an artist and an admirer of the old Warner Bros. cartoons by Tex Avery and Chuck Jones. In EMPIRE his maneuvering of the Imperial TIE ships and the Millennium Falcon show his great understanding of the need for timing, motion and life within the shot.

QUESTION: What is your reaction to the new VistaVision adaptations that have been made for shooting this picture?

MUREN: They're up to date and they're very nice. Of course, we've had some problems with them, but that's to be expected of any prototype equipment. The next generation of equipment—and especially the motion-control equip-

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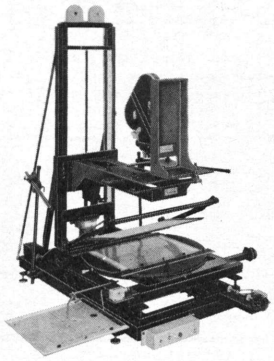

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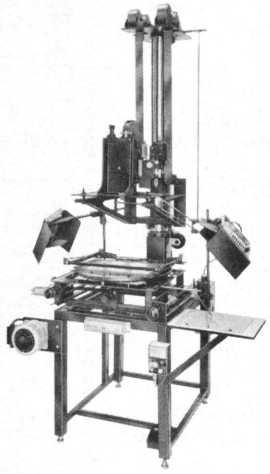

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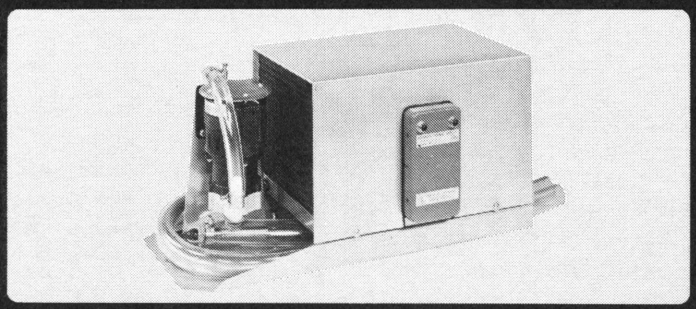

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ment—will be very different from what we have now, but that will be coming up on the next show. We are sort of in an in-between stage now, trying to decide which way to go with equipment. The first big breakthrough came on STAR WARS and now we're looking for the next big one to evolve on the next show. There's some very interesting stuff that the electronics people are going to be doing to change the programs and the motion-control systems for the next generation. Of course, a lot of the motion-control equipment developed for STAR TREK and THE BLACK HOLE is primarily applicable to spaceship shots, and that's about it. When you're dealing with something like EARTHQUAKE or THE TOWERING INFERNO, that kind of equipment doesn't do you any good.

QUESTION: That being the case, do you think these new generations of motion-control equipment will pay off?

MUREN: It's going to be interesting to see which way the trends of filmmaking develop from this point on, and whether the space cycle is going to continue—or if there is going to be a lot of equipment for sale for shooting spaceship movies. Many people think there aren't going to be a lot of new spaceship movies coming out. These things run in cycles and we're wondering how long the space cycle will continue. Actually, George Lucas seems to be drifting away from space action. In THE EMPIRE STRIKES BACK there is the Walker sequence, the Cloud City, the Tauntauns and the Bog Planet—none of which involve space action. People who go to see EMPIRE expecting to see a space film are going to be pleasantly surprised to find that there isn't that much space footage in it. George Lucas is an innovator and he knows what not to do again, as well as what to do again. He's a very sensible man. He really understands the problems involved in doing this sort of work—and it's a great pleasure working for him. ■

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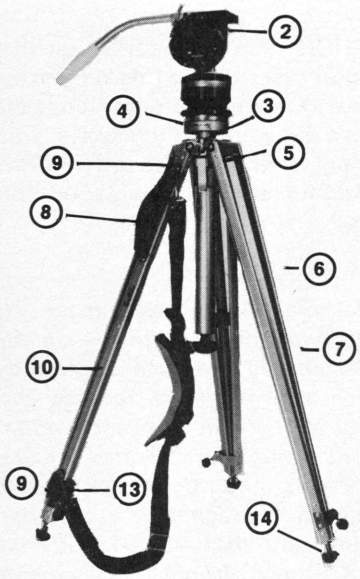

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THE PHOTOGRAPHY OF "THE EMPIRE STRIKES BACK"

Continued from Page 577

plates—so there was quite a lot of shooting in the studio with the VistaVision camera and the actors in front of a blue screen.

QUESTION: What photographic equipment did you use for the rest of the filming?

SUSCHITZKY: On the rest of the picture we used a combination of the PSR and Panaflex-X cameras. Toward the end of the filming—for the last two or three months—we switched over to a normal Panaflex. We then used the Panaflex-X as a second camera and an Arriflex as a third camera. Because there were many difficult and physically awkward sets, which involved climbing over various forms and up ramps and so on, we needed a lightweight camera. I operated the second camera a lot of the time, as I quite enjoy picking off things whilst the main camera is working. We had a full range of lenses from 30mm upwards, but as far as I can remember, we never used a zoom.

QUESTION: When you were working with the VistaVision camera, did the fact that the lens focal length of this equipment has to be twice that of normal anamorphic give you a depth of field problem?

SUSCHITZKY: It did really, because we had a lot of scenes which involved a pilot in a spacecraft against a blue screen. In order to get a good matte line, one would have to hold not only the pilot and the foreground sharp, but also the distant wings and tail, which meant working up to f/12.5 or f/16 on occasion.

QUESTION: To what extent was a second unit involved in the filming of THE EMPIRE STRIKES BACK?

SUSCHITZKY: We had two units working on the film continuously. I had a second unit which was designed to work alongside the main unit and pick up little bits and pieces that were left behind. It then developed into a unit to pick up quite big chunks which we had to leave behind, and also the matte work. I coped with the two units on different stages for the first 12 weeks of the picture, with the aid of a bicycle which I used to commute, and carrying a radio to call me back to the main stage. I then decided, after 12 weeks, that I needed another cameraman to help me out with the second unit and the matte work. I got

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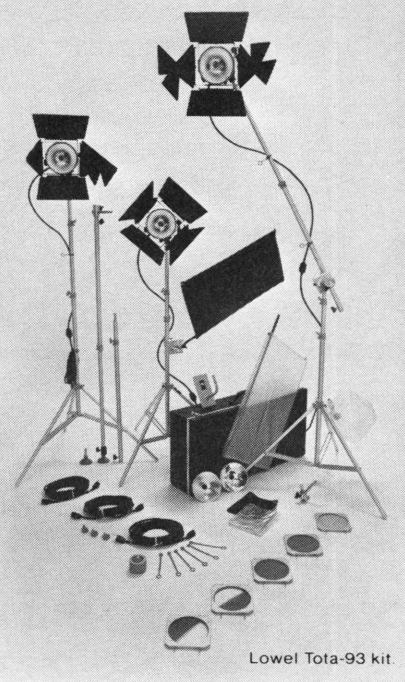

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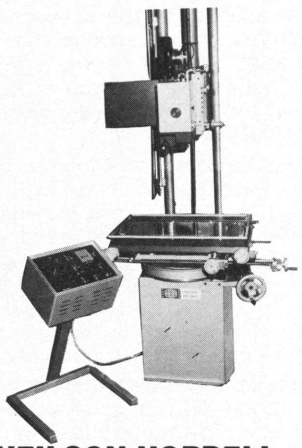

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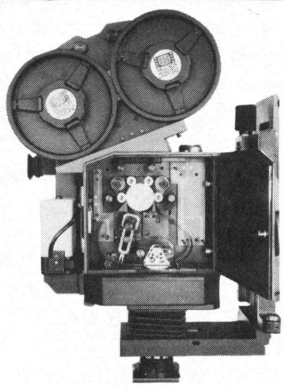

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Chris Menges (and for a short period I had to have somebody else when he had to go away for a bit), but the cooperation was always very satisfactory. I must say that he matched what I wanted perfectly and never resented the fact that I would cycle onto the stage with no notice at all and ask him to change things. But it meant that I was stretched on the film and I used to have people ribbing me about my bicycle, which must have done quite a few hundred miles between the stages and the different units.

QUESTION: You said earlier on that you hadn't had a great deal of experience with special effects. What differences did you have to make in your shooting techniques in order to accommodate special effects on this picture?

SUSCHITZKY: When you use the term "special effects", the only thing I was relatively unfamiliar with was matte work, although I had done some, and I now feel quite confident about it. That mystical term, "special effects", didn't involve anything else that I hadn't experience before, and I don't think I had to alter my lighting technique at all, apart from the fact that occasionally we needed a very high light level in order to cope with the depth of field required for the matte shots. The other special effects were the normal sort of things, such as explosions and practical lights in machinery and my lighting was governed by that sort of thing on a technical level. Whenever we had the character R2-D2 on the set, which was very frequently, I had a special problem. I had to discover early on what was the right light level for him, so that he would look good photographically, yet his practical lights would shine through, but I don't think this is a very unusual or particularly interesting technical point, and I don't think I had to change my lighting style at all because of any special effects.

QUESTION: How do you define your normal lighting techniques?

SUSCHITZKY: Well, I like to think that I change the lighting according to the demands of a scene and the set. In my work the lighting generally always evolves out of how the scene is played and how the set looks. Thus, I am never 100 percent sure of what I am going to do before we shoot. Naturally, I have to know approximately what I am going to do, because I have to plan what's going to be rigged. I think that when you see THE EMPIRE STRIKES BACK you will see that there are scenes which have hard light and are extremely contrasty,

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stretching the limits of the emulsion, and some have soft light. Some are lit from underneath, some from overhead, and some from behind. I hope that this apparent disparity of styles will actually bring its own sort of unity to the film and won't create a fractured effect. I actually feel that there is an internal unity to the lighting style, but there wasn't one imposed from the outside that said that we were going to light everything from the right or from the left, or that it all had to be soft light or hard, all on a wide-angle or a telephoto. The style varies from sequence to sequence, but I really think that it has its own unity.

QUESTION: Were there any lighting set-ups of a particularly unique character?

SUSCHITZKY: There were some very tricky set-ups indeed. We had one set with a glass tube in the middle of it, with Luke Skywalker suspended in a kind of liquid. I don't know whether the scene survives in its entirety in the finished film, but I had to devise a method of lighting this tube so that it would be very bright and the rest of the scene would be extremely low key—the tube would be the main source of light in the set—and I hit upon the idea of suspending a large mirror halfway up the studio above the set and a searchlight down below. The light from the searchlight would bounce off the mirror, which worked marvelously well until the mirror shattered once or twice, I believe, from the heat of the searchlight. There were other sets which presented their own difficulties.

QUESTION: What were some of your other challenges?

SUSCHITZKY: There was another set in which a sword fight was to take place between two of the characters. When I looked at that set it struck me as being rather like a model for a stage set. In other words, it looked unfinished. It certainly had no walls at all; it was a series of ramps and discs and blackness. I was extremely concerned about that set and I thought about it a lot, about how I was going to make it work and look believable and look dramatic. Then I decided to light the whole thing from underneath, as the floors had been made translucent. In the black areas I placed Brutes and had shafts of light penetrating the darkness. Then the whole set was filled with steam, which made it photographically very impressive, but physically very uncomfortable, since it was like working in a Turkish bath. We were quite high up in the stage and we all suffered for quite a number of

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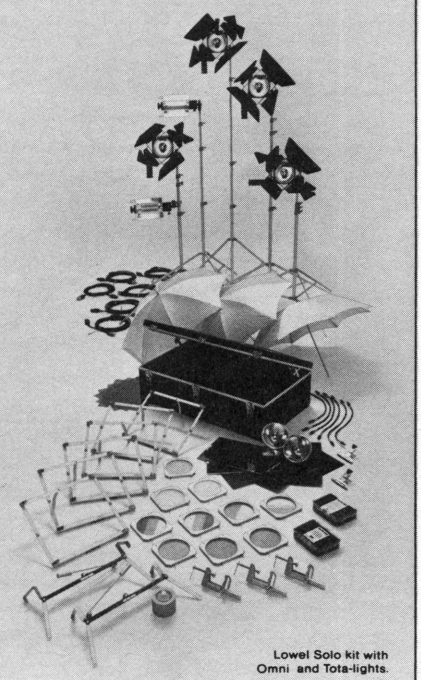

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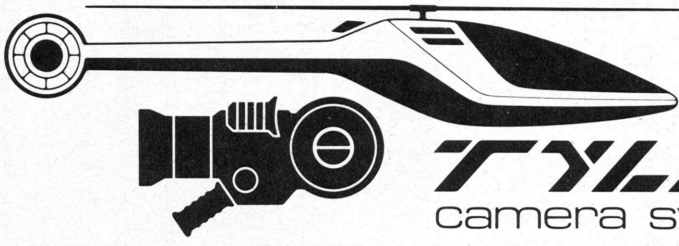

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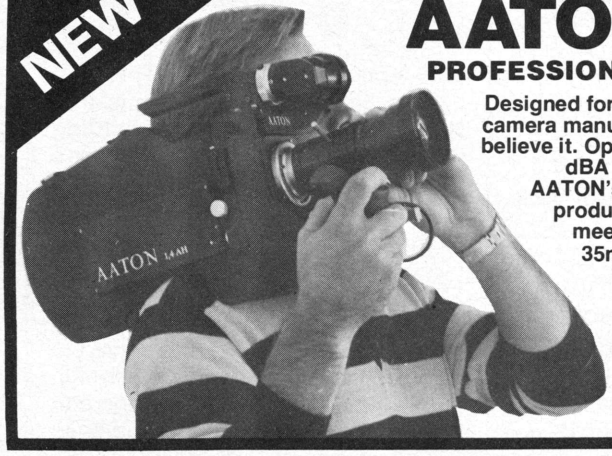

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weeks, but it was one of those sets which made me feel uneasy before I entered into the shooting of it because it looked so unreal, so unworldly and unlike anything I had ever done before. I was concerned about it looking dull, in fact, because although there seemed to be plenty of material in the set, it was all either on the floor or on the ceiling. The fact is that unless one goes for extreme angles (and you usually can't do that right through a long sequence), the camera is pointing straight ahead and not up or down. There was nothing for the eye to look at straight ahead except blackness, because all the set elements were on the floor or the ceiling. I was concerned about the scene looking interesting and about the eye having something to look at—but, in the end, I think we succeeded in overcoming those problems—all of us working together.

QUESTION: You said you used steam as one of the means of diffusion. Did you use smoke at all?

SUSCHITZKY: The steam in this particular set was there because it suited the scene that was being played. I used very little smoke, except occasionally when the scene actually called for it because of explosions. I used to use smoke quite a lot a number of years ago, but I have always been a non-smoker and I've gotten more and more around to the idea that breathing in smoke all day and going home smelling of smoke is far from a pleasant experience and probably not worth it in the long run. It may be better to have a cleaner image and better health. (This doesn't mean to imply, however, that I haven't admired the results that other cameramen have got with smoke. In fact, I have enjoyed what I got by using smoke.)

QUESTION: Was there any one set that was especially awkward to work in?

SUSCHITZKY: We did have one set which is probably the most awkward set I have worked in for many, many years. There were plenty of difficult sets, but this one was really physically awkward. It was the house belonging to the Wampa creature, played by a Muppet, and as he was quite small, they built the house to suit him and not to suit a human being. Then we had to place Luke Skywalker (a human being) in the set and he could only sit down in it. Even so, he just barely escaped knocking his head against the ceiling. The set had three sides and virtually nowhere to conceal the lights. It had a fire going and that's about all. I found it very difficult and

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painful to light and I had to crawl on my hands and knees into it, as one would in a mine at the coal face.

QUESTION: Did the robots present any special lighting problems—reflections from their metallic surfaces, for example?

SUSCHITZKY: The mechanical characters in the film didn't present any special problems, apart from C-3PO, who was very shiny, thus causing one to be very careful about reflections—seeing oneself with equipment reflected in his surface, to be specific. There were people inside both of the robots. C-3PO, in fact, has an actor inside of him all the time and that gives him a very particular character. I think the actor is very clever at it. R2-D2 was portrayed by a series of different models, sometimes radio controlled, sometimes pulled along, and sometimes with a small man inside him, according to the demands of the scene. Some of the models will roll on certain surfaces and do special things, and others will perform different functions. They don't seem to be able to put all of the functions into one model.

QUESTION: Are there any other particularly unusual lighting set-ups that you can recall?

SUSCHITZKY: I can recall many, but they would not be too unusual. However, I can recall one instance when we were filming inside what we called "Cloud City". I think it comes toward the end of the film, and it was basically a series of corridors and one long hall. Although we had quite a few corridors, one often wants to make a set look bigger than it really is. For example, in one particular shot—where the camera tracked down a corridor, around a corner, up another corridor, and then back into the same corridor—I wanted to make the return into the same corridor look like a different one. So whilst the camera was round the corner, I worked out a series of light changes to be done rapidly during the shot, so that by the time we got back into our old territory, it looked like a new and differently lit corridor. I think the film was full of demands upon the mind like that, which amused me tremendously and made the whole thing much more interesting than it normally would be.

QUESTION: Most cameramen have their own little secret tricks or techniques and tend to guard them rather jealously. Do you have any of those?

SUSCHITZKY: No, I'm not a cameraman who has secrets. There aren't any

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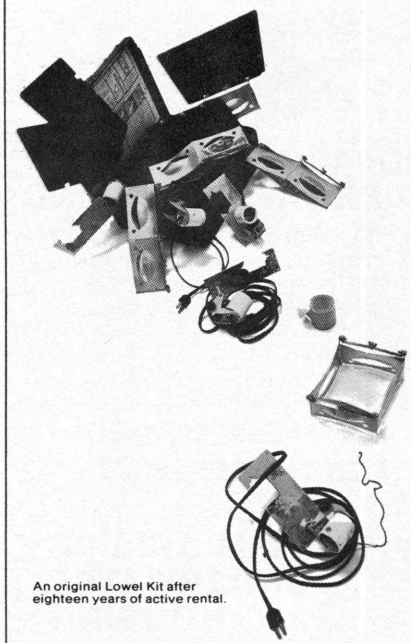

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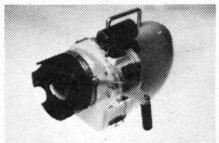

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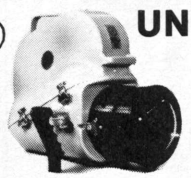

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secrets, really. There are few technical tricks of significance. I don't go into a film saying that I'm going to do the whole thing with a wide-angle lens or a #5 diffuser, because I think that is inflexible. I really feel that a cameraman should serve the film, serve the director, and not feel that he is going to superimpose his style upon every film, because the photographic style should ideally change from film to film, evolving from the dramatic demands of each particular film. I hope that I don't sound pretentious when I say that, in terms of my own career, it may be the experiences outside films that affect me more than anything else—far more than other films, for instance. Hence, it's probably the paintings seen, the music heard and the book read which may influence my work more than anything else. Now I don't think to myself that I am going to manage a scene or film like a Mondrian or a Rembrandt, but I believe that if you are functioning well as a human being, that later on (maybe years after the event), you may subconsciously draw upon a personal experience that may have nothing to do with films—a piece of music heard, a book read, or somebody you met, and you just never know how it is going to come out. If you go into a film saying, "I'm going to do it all with a 50mm lens or a #5 fog"—you are locking yourself down and preventing yourself from being flexible. On the other hand, if you go into a film with a degree of uncertainty and an open mind—and you are secure enough to be a little insecure—I think that you will emerge with a far more interesting result than if you go into it knowing precisely what you are going to do.

QUESTION: In summing up, do you have any final observations regarding your assignment on THE EMPIRE STRIKES BACK?

SUSCHITZKY: Only that I haven't enjoyed myself so much on a film for a very long time. I worked with a director with whom I really got along tremendously, who encouraged me to do my utmost, and so I had a ball on it really, and lots of large toys to play with. What more could one want? ■

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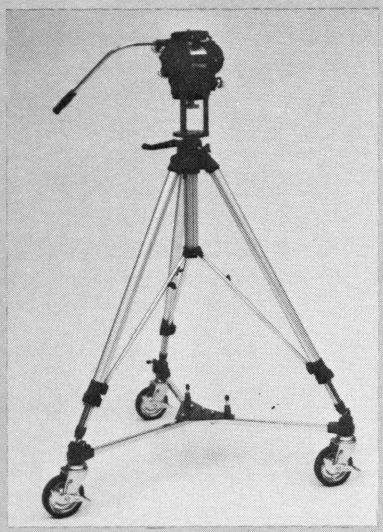

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Continued from Page 594

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Finse, Norway, is a small village of 75 inhabitants nestled below a more or less circular glacier 5 miles in diameter, 300 kilometers WNW of Oslo. This glacier was to provide the "snow planet" setting called for in the script and certainly wasn't a disappointment in that respect. High winds, drifting snow and cold temperatures would be common during March and April, so special arrangements in equipment preparation would be necessary.

In an operation such as this, we had the camera equipment plus the helicopter to consider. Marc Wolff, an extraordinary free-lance film pilot with whom we had worked before, was contacted in London and it was agreed that he should handle the logistics with production, as well as performing the demanding flying assignment.

From the outset, it became evident that only one type of helicopter was truly suitable for this job given the glacier's altitude of 6,000 feet, plus the maneuvers involved allowing a margin for safety, and that was the Aerospatiale Lama 315B. This, in fact, has always been our preferred aircraft, as it has approximately 60% more power than a Jet Ranger in more or less the same size aircraft and can perform effortlessly at just about any altitude.

Unfortunately, no Lama was available in Norway at that time, so it was necessary to put the bureaucratic machine in gear and obtain Norwegian permission to import one from England for the shoot. In addition Norwegian military permission had to be obtained in order to film and this almost became our undoing. We will always feel indebted to Ole Jacobsen, Flight Director of Helitourist, for sitting in offices for a number of days negotiating delicately with military officialdom in order to obtain the first aerial filming permission granted by Norway to a foreign registered aircraft, flown by a foreign pilot and carrying a foreign cameraman and assistant. This problem is particularly difficult for North Americans and the British to understand, but it arises frequently in Europe and is something that we have learned to cope with, although in this instance it threatened seriously up to the last moment the entire aerial section of the film.

A suitable shelter for the helicopter would have to be erected at Finse and for this a tent-type structure was assembled with electricity provided for heating both

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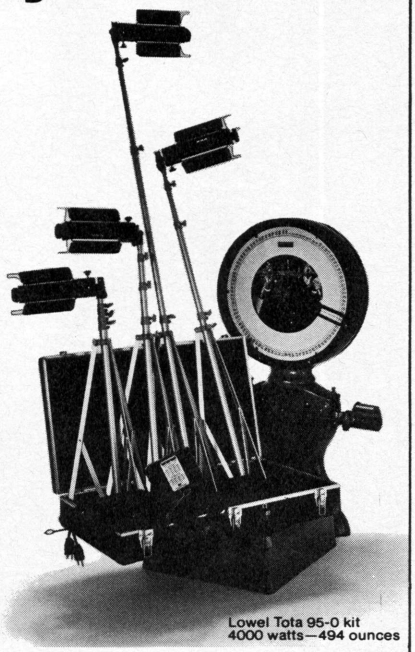

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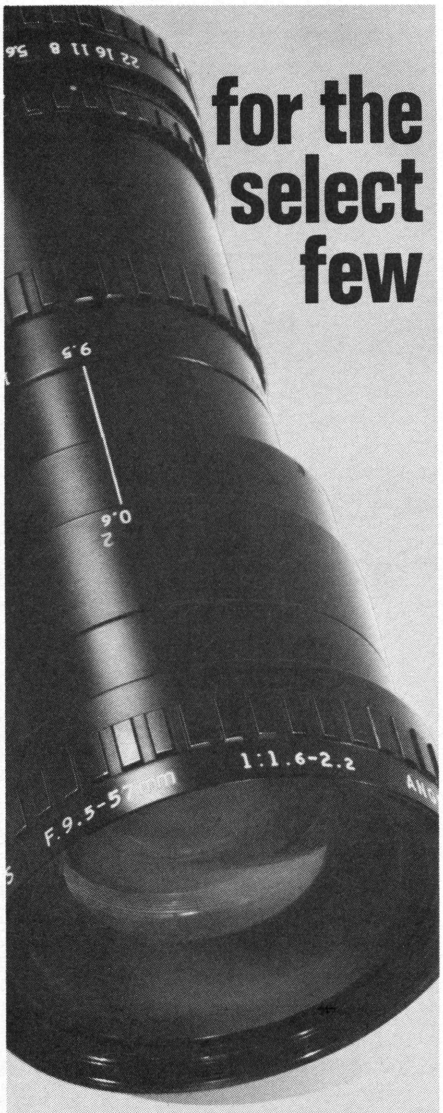

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the helicopter and the camera system during the evenings.

Next came the substantial problem of installing a VistaVision camera in a Wesscam mount. We had selected the lightweight "Paramount" version without look-through and based on the "butterfly" magazine arrangement which involves a horizontal magazine positioned across the back of the camera and resembling the wings of a butterfly. This setup made the loaded camera much wider than it was long. (Approx. 2.5 feet with 1000-foot magazine.) This was an impossible size for us to deal with, so we set about designing and manufacturing an adapter channel that would guide the film from and to a Cinema Products 1000-foot. XR35 magazine mounted lengthwise and centered behind the camera body. With some slight temporary changes within the camera body, this arrangement worked out quite well. The "lower" surfaces inside the CP mags were lined with the low stickion paper found between double-sided tape coming in rolls (this had the lowest friction coefficient of a number of materials tested), to permit the 1000-foot rolls to turn easily on their sides. In addition, the standard drag brakes on the feed side of the mags were removed, as the weight of the film roll against the lower surface provided sufficient impedance for the roll to stop reasonably quickly when the camera was switched off. Initially the spring-type take-up belt was extended through ball-bearing rollers to provide take-up, but this was later eliminated and a small separate torque motor was installed to handle this task.

A rigid frame was made up to hold the camera and magazine arrangement. A servo drive for the Nikkor lenses' iris settings was installed, as well as a Sony model 1450 TV camera with 6mm lens to provide viewfinding on the TV monitor located inside the helicopter on the control console. On this monitor three different "boxes" were marked out corresponding to the field of view for the three Nikkor lenses we anticipated using: the 28mm, 35mm and 50mm. Parallax problems were nonexistent for us, due to the infinity distances and the short focal lengths used.

It was necessary to compensate for the weight shift of film as it moved from the feed to the take-up end of the mag, so the normal footage counter that was mounted on the camera door was removed and a speed reducer gearbox installed in its place that was driven from the constant speed film drive sprocket inside the body. This was connected through a flexible shaft to a weight on a feed screw inside a tube guide that would be driven forward as the film moved

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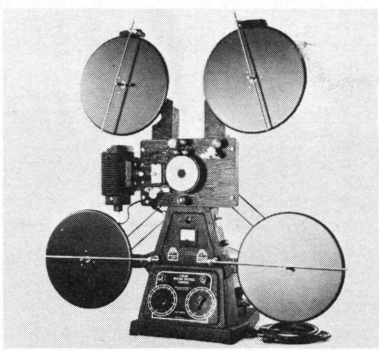

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rearwards in the magazine.

The resulting assembly was positioned on a joint that allowed the whole thing to tilt from 30 degrees above to 90 degrees below horizontal. It was especially important to maintain a short distance between the window opening in the "dome" of the system and the camera to allow the 28mm lens a clear unobstructed view.

The standard 28-volt DC camera motor presented some problems in that it was not designed to run the camera at the slow speeds (6 fps or less) that we wanted to utilize. The lowest acceptable speed that we could obtain was 10 fps. This entire motor setup was rather primitive, with a simple rheostat speed control, but because of time considerations, we couldn't set out to replace it with a new motor and control circuit as we have done since. Instead, the governor plate was removed and a small brass flywheel installed. A new rheostat control box was made up with a coarse and fine control rheostat. These changes allowed the camera to run smoothly with film down to two fps.

In addition to utilizing the Wesscam system normally (i.e., with controlled, level, vibrationless results), it was also necessary in the script to duplicate the high-speed "banking" effects of the "Speeder" spacecraft in combat situations with the "Walkers" on the surface of the Ice Planet. For this it was necessary to use the Wesscam in a configuration somewhat at odds to its design. However, vibration clearly was not desired, so the system would have to be married to the helicopter in terms of roll (banking) and yaw (turning left or right) but without a total hard connection that would transfer vibration into the camera. To do this, three of the five systems relating to elimination of movement were taken out of service and the camera, in effect, became an extension of the aircraft, turning, banking and diving with good vibrationless results even at camera speeds of six fps. Tilting control of the camera was retained so that the horizon could be positioned where required in frame.

The entire equipment preparation, including the making of the new camera platform, was done in four weeks of long days by myself and camera assistant Margaret Herron who, by the way, became very adept at operating the vertical milling machine.

A test flight and camera test were done to confirm proper operation of all systems prior to actual scheduled filming.

The day finally arrived when we rendezvoused with the helicopter in Voss, a small town about 40 km from Finse. The aerial crew consisted of Marc Wolff, pilot; Michel Vautier, helicopter engineer; Margaret Herron, camera assistant, and my-

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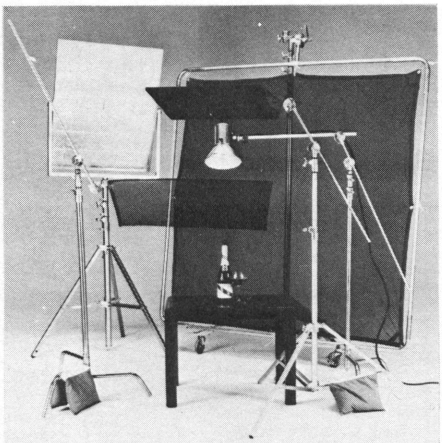
self. We installed the equipment and flew the short distance up to location in fine sunny −10°C weather.

For the next two days the weather held and we managed to film quite a good number of plates including eight or nine versions of a background shot that was, at that point, intended for the opening of the film. This shot involved climbing to 15,000 feet altitude and falling in "auto rotation", with no power from the engine going to the rotors of the helicopter. In such a state the machine can fall at 2500 feet a minute or approximately 30 mph and when this is multiplied by four and combined with a forward effective speed of 400 mph as the camera levels out over the snow at between three and six feet, the result can be quite effective. As it turned out, however, the fine weather didn't really match with the majority of the other "Ice Planet" footage so these long takes ended up being used as supplementary short background plates.

The work load at this point fell squarely on the shoulders of Marc and Margaret. The flying was very demanding. Maximum high speed effect is, of course, obtained at the lowest altitudes possible. Trees or any other type of obstruction did not exist for the most part but the exact distance over the undulating snow field flying past at 100 mph was very critical, especially when our average height was four feet or so. It was possible for Marc to be oriented to height only when he could discern a texture on the snow surface below, and for this, hard or bright sun was required to give some contrast. Therefore, flying became impossible on many days due to "white out" or at least "gray out" conditions when the horizon blended invisibly into the sky.

Margaret, in addition to her normal camera duties, had the quite unique and difficult job of riding shotgun on the camera speed. We discovered, quite to our concern, that the camera speed was relating to some of the maneuvers that Marc was putting the helicopter through. It became clear that the camera would lose speed as G forces increased and gain speed if the G forces lessened. On most shots we and the equipment were subjected to between 0 and +2 G's. When we were in steady and level flight, the camera would run perfectly constant. We concluded that the higher G's increased the pressure between the horizontally lying feed side roll and the bottom of the mag, thereby increasing friction and slowing the camera and vice versa. So, Margaret's difficult task was to anticipate these G force changes and maintain constant camera speed and, therefore, exposure.

At the outset, we sat down and divided the shot list up into four categories. The



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support arms that we have for the Lama allow the camera to be mounted on either the left or right side and, although the change can take as little as 10 minutes, we decided to avoid changing back and forth unnecessarily. Since the camera is not centered in the dome, it is better to shoot forward-looking shots with the system on the left of the helicopter and rearward shots with it on the right, as the camera is positioned farther away from the helicopter and there is less possibility of getting a portion of the machine in the shot. Therefore, we divided the shots into: 1. left normal functioning, 2. left "banking" function 3. right normal functioning, 4. right "banking" function.

In addition we had to repeat a large proportion of shots at different camera speeds and with different focal length lenses. From the initial test, it was decided that the 35mm Nikkor would be the main lens to use for most of the shooting. The 28mm was used for certain plates, but the 50mm was generally thought to be a little confining in scope. As a rule we attempted to use the same lens that we would use if we were actually beside a "Speeder" or in the cockpit.

The extremely high light levels presented an exercise in the use of ND filters, especially at the low undercranked speeds that we were using. Toward the latter part of the shooting we were venturing down to four fps and at one point we filmed a couple of plates at our lower limit (at that time) of two fps. Typically we would use a .9 ND on the front and a .3 or .6 gel on the back. At one point we had a .9 glass on the front with a .9 on the back to allow us proper exposure at the two fps camera speed. Generally we tried to keep the same 85ND gel in the camera and only change the glass ND on the lens front in order to avoid the blowing snow on the surface of the gel.

The "average" weather that we were entitled to expect (according to meteorological records going back 50 years or so), was about one out of two days sunshine and clear conditions but that just didn't happen and after the initial two days we found ourselves waiting most of the day, only to "scramble" for less than one mag's shooting before the weather closed in again.

On the glacier itself, the conditions could be extreme and, due to the isolated nature of our shooting, we did not shut down the turbine on the helicopter for fear that it might not start again and we might be stranded when we reloaded or made adjustments.

The closed and heated environment of this helicopter set-up was the only way to function for this type of filming. At one point we had −35°C with a 40-knot wind and it took 20 minutes to reload the cam-

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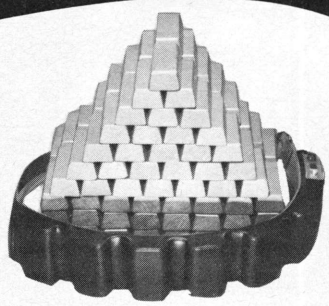

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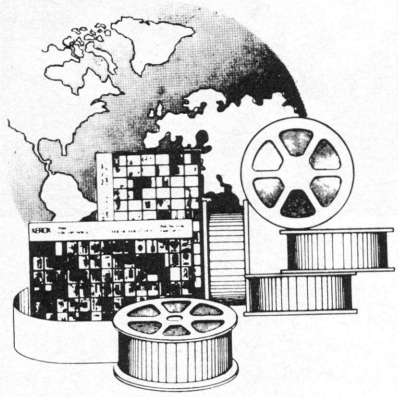

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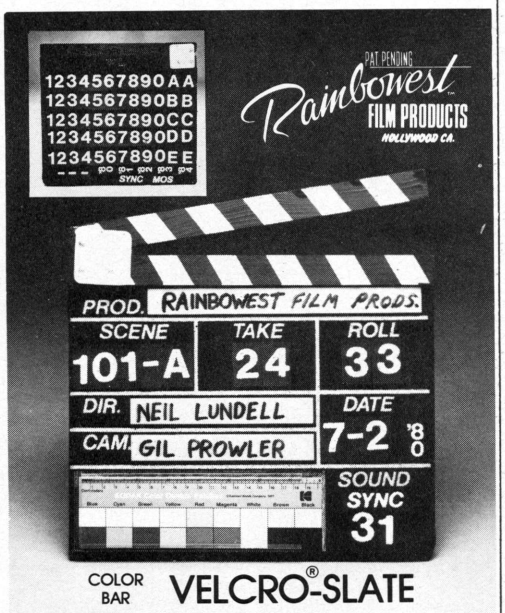

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era, when normally the operation can be done in three or four. Winds actually exceeded 65 knots on one night, but our hangar tent held. We heated the interior of the chopper in the evening with a small electric heater and the camera system was left on the aircraft at night and heated by an infrared bulb. This provided a very satisfactory solution and could maintain a 30-degree C difference between the interior of the dome and the exterior conditions. During the day the "greenhouse" effect of the dome with its window and black interior usually kept the temperature above +5°C, without additional help.

Our initial scheduled period passed and, due to the weather conditions, we were still left with 30 or so plates when we broke for Easter. (It was impossible to film, due to the traditional influx of cross country skiers during this 10-day national holiday.) Until now we had only seen video-taped dailies taken from the screen of a Moviola-type viewer back in London and we weren't by any means relaxing because it really was impossible to get a proper idea of quality from this. During the Easter break, however, I was able to fly to London and view rushes properly.

We resumed shooting after the holiday and, although the conditions had improved marginally, we still had to wait most of the time on the ground. Finally we finished the shot list just a day or so before the agreed cut-off date with the Norwegian authorities and even managed to pick up a few extra static plates missed earlier by the ground camera crews because of bad weather.

THE EMPIRE STRIKES BACK was in every way one of the most interesting projects in which we have been involved. It was especially satisfying to us because it involved the design of special equipment and working in a big beautiful format that increases the visual impact of an aerial camera so much.

In all, we shot really very little film for this type of work in the VistaVision format; 33,000 ft. to be exact. The shortcomings in the camera motor department have since been rectified, with a digitally controlled closed loop system providing exact camera speeds from three fps to over 30 fps, and other improvements have resulted in what we feel is a very valuable system for aerial and other types of stable background plates, as well as normal production shooting. ■

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BEHIND SCENES OF "THE EMPIRE STRIKES BACK"
Continued from Page 601

A second unit was formed to aid in speeding up production, and John Barry, the Academy Award-winning production designer of STAR WARS, was hired as second-unit director. Unfortunately, a tragedy marred the movie's progress. Two weeks after he started on THE EMPIRE STRIKES BACK, Barry became ill and died. Work stopped for an afternoon while his colleagues attended his funeral, paying their respects to a lovable man who had contributed much to the motion picture industry. Producer Gary Kurtz took over direction of the second unit until a replacement, Harly Cokliss, could be found to replace Barry.

But compared to some films of similar size, the problems were minor and the enterprise pressed on. The redeeming factor, of course, was the quality of the footage, which made the struggle to film the complex interiors all the more worthwhile.

The movie, in fact, was made on two levels—at the studio at Elstree and at ILM. Lucas and Kurtz had the ultimate responsibility of keeping these two dimensions accurately interlinked. Lucas flew in from California from time to time, joining editor Paul Hirsch in the cutting room, while Kurtz gave technical advice uniquely his as the producer of STAR WARS.

Four big sets seem, in retrospect, to have been the peaks across which the filmmakers climbed to completion of principal photography in late September. These were the Cloud City complex of Bespin, its carbon-freezing chamber, the ice hangar on the planet Hoth, and the swampy planet of Dagobah. Of them, the cool, beautiful, streamlined interiors of the Cloud City were the easiest to work on. The huge hangar, which inaugurated the STAR WARS stage, dwarfed actors and technicians alike with its full-scale hardware and vistas of solid ice. When the set was struck, the big stage was occupied by the swamp planet, an interior which, with its twisted trees, fetid lake, mist effects, and humidity, proved to be as uncomfortable to work on as any tropical jungle location. But, by far, the most taxing was the carbon-freezing chamber, a forty-foot-high cylinder within a complex of spiralling metal, full of gadgetry, some of which emitted steam. This set had no redeeming factor for the crew, except its impressive impact on the screen.

From springtime through fall, the filmmakers labored on sunless stages until, quite suddenly it seemed, photography was complete. The intricate props, cos-

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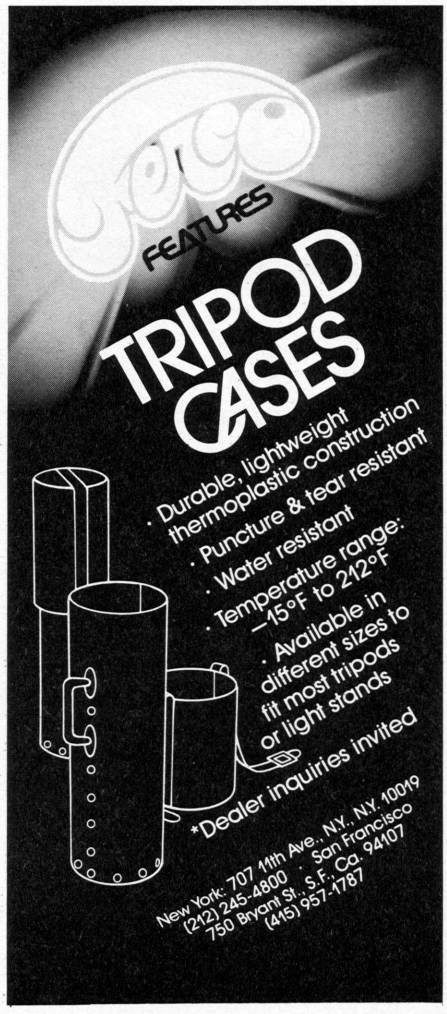

tumes, and hardware were put into storage and the crew dispersed.

For most films, that would be the end of the story, but not for movies of the STAR WARS variety. Completion of principal photography was, in a sense, a beginning. Months of work followed, particularly in the special effects labs at Industrial Light and Magic, where miniatures, opticals, animation, and other processes had to be meticulously integrated with the live-action material of the rest of the film. By late fall, an exceptionally complex sequence in which the *Millennium Falcon* flies through an asteroid belt pursued by TIE fighters had been completed. A technical problem requiring experimental research arose when it was clear that a white matting, instead of the usual black, was needed for scenes showing combat craft against snow, but this was successfully solved.

John Williams, who recently replaced the late Arthur Fiedler as the conductor of the Boston Pops Orchestra, completed 108 minutes of original music for THE EMPIRE STRIKES BACK, and recorded them at the Anvil Recording Group's studios at Denham, near London, with the London Symphony Orchestra under his conductorship. In addition to four new themes inspired by THE EMPIRE STRIKES BACK, three of the main themes from Williams' score for STAR WARS were reprised. ■

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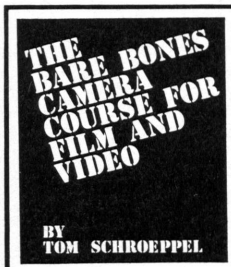

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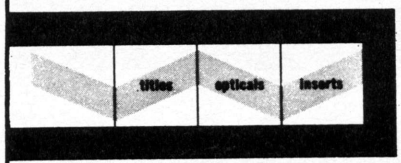

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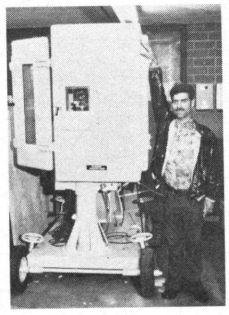

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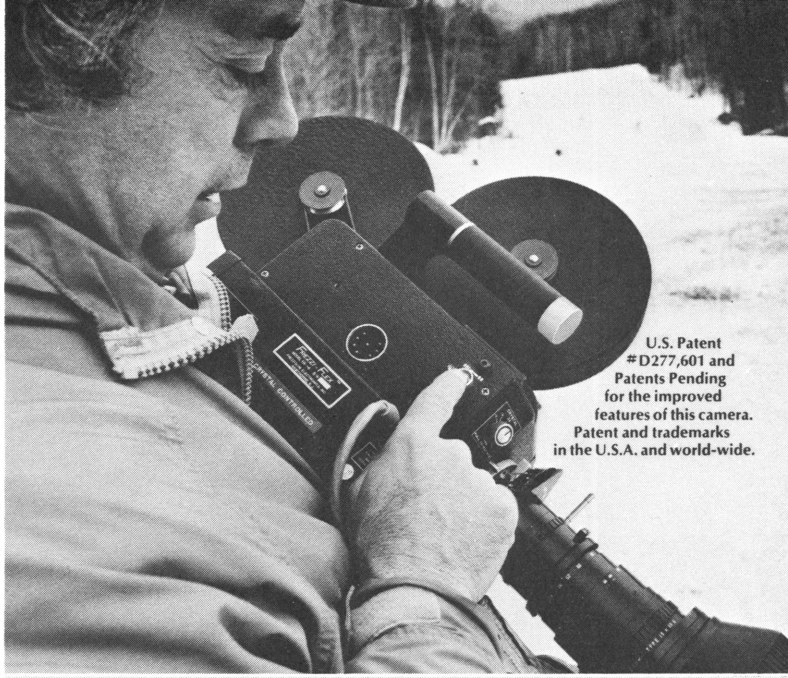

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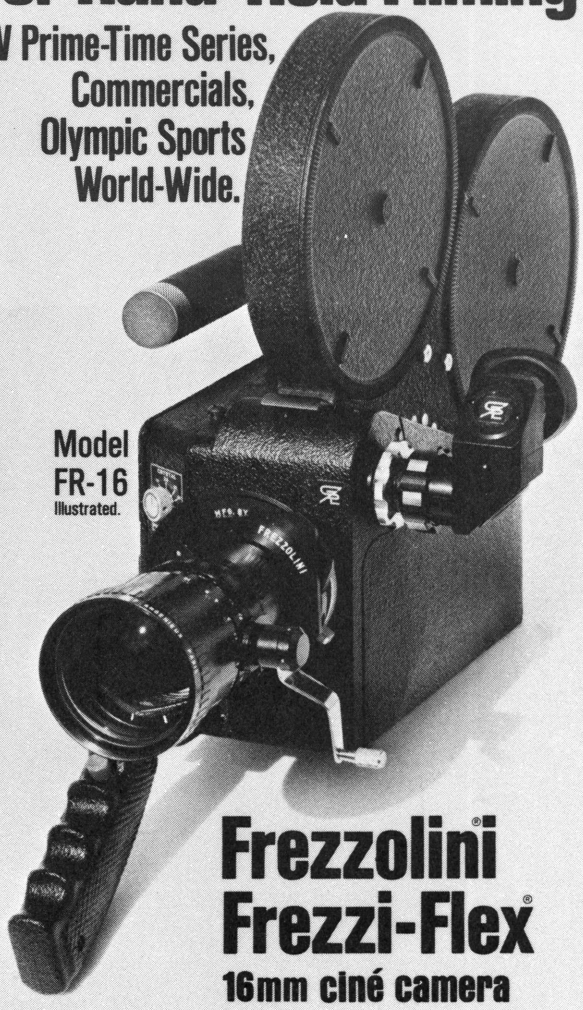

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